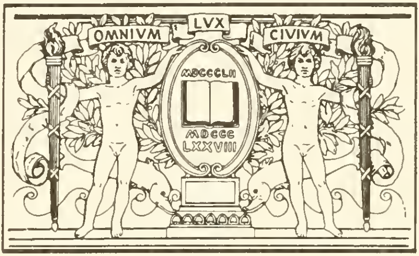

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ACID RAIN CONTROL
(Part 1)

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HEARINGS

BEFORE THE

SUBCOMMITTEE ON
HEALTH AND THE ENVIRONMENT

OF THE

COMMITTEE ON ENERGY AND COMMERCE
HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST AND SECOND SESSIONS

ON

H.R. 3400

A BILL TO AMEND THE CLEAN AIR ACT TO CONTROL CERTAIN SOURCES OF SULFUR DIOXIDES AND NITROGEN OXIDES TO REDUCE ACID DEPOSITION AND FOR OTHER PURPOSES

DECEMBER 1, 9, 1983, AND FEBRUARY 10, 1984

Serial No. 98–114

Printed for the use of the Committee on Energy and Commerce

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(Part 1)

United States : Congress House Committee on
Energy and Commerce.

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ACID RAIN CONTROL

THURSDAY, DECEMBER 1, 1983

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Health and the Environment,
New York, NY.

The subcommittee met, pursuant to call, at 10 a.m., at Two World Trade Building, 44th floor conference room, New York, NY.

Mr. Waxman. The meeting of the Health and the Environment Subcommittee is called to order. Today's hearing marks a renewed effort to control our Nation's most devastating environmental problem—acid rain. Acid rain is not a new problem. Our Nation's scientists, including a panel handpicked by the Reagan administration, agree that there is an immediate need for a comprehensive solution. Rainfall as acidic as vinegar is falling in virtually every State, corrupting our natural resources, lakes, farmlands, and forests and eating away at our buildings, automobiles, and monuments.

In addition, scientists now suspect acid rain directly threatens health by adding poisonous metals to drinking water supplies. Some studies even suggest that acid rain may be linked to Alzheimer's disease, a form of dementia caused by the degeneration of brain cells.

The absolute need for action is graphically illustrated here in New York. From the Statue of Liberty to your beautiful lakes and forests, the damage has been pervasive, extensive, and expensive.

Although the problem transcends State borders, the Federal Government has been stymied in initiating even a limited control program, primarily because legitimate concerns have been raised about possible adverse employment and utility rate effects, particularly in the Midwestern States. And we will be unable to pass acid rain control legislation so long as it is synonymous with massive job losses and electric rate increases.

Yet these concerns cannot keep us from protecting our environment. We have the responsibility of harmonizing all the competing concerns. Representative Sikorski's innovative bill, H.R. 3400, does this. It protects New York's environmental interests, while ensuring that Ohio will not suffer enormous economic dislocation.

In recent months, despite the failure of the administration to convey its promised proposals, we have been heartened by the tremendous support given to H.R. 3400. The bill's 108 cosponsors come from both parties and all regions of the country. But although House cosponsors for acid rain legislation have almost tripled from a year ago, Congress needs to be convinced that acid rain legislation cannot wait for future years. This is happening and the effect is being led by New York's government leaders.

Support in the New York House delegation—led by Representatives Scheuer, Ottinger, Molinari, Boehlert, and Martin—has been outstanding, with 23 Members cosponsoring H.R. 3400. In the Senate, Pat Moynihan has been both effective and eloquent in pressing for immediate acid rain controls. And the importance of Governor Cuomo's leadership on this issue cannot be overstated.

There is good reason for New York to lead the fight. It will be one of the principal environmental beneficiaries under H.R. 3400. Sulfur oxide and nitrogen oxide emissions will be cut by 14 million tons by 1995, with much of these reductions occurring upwind of New York. This could mean an equivalent sulfur dioxide emission reduction of as much as 50 percent.

Adoption of this bill will mean that far fewer quantities of these pollutants will be brought into the State's Adirondack Park, Catskill Park, Hudson Highlands, and other sensitive areas which are now suffering from severe acid rain damage.

Although the bill imposes a nationwide fee-sharing system, New York consumers would not face steep electric rate increases. The average effect would be a 1.5-percent hike in rates, which translates into less than a $1 addition on a monthly electric bill. That New Yorkers are willing to pay this small fee is clear. In a recent poll many New Yorkers said they would be willing to pay far more per month on their electric bills for effective acid rain control.

The public will not be fooled by rhetoric and wants action, and I hope this hearing will prove to make that more likely.

I would like to recognize at this time a number of our colleagues who are sitting on our subcommittee panel today and have been involved in this issue. First I would like to call upon the lead author of H.R. 3400, Congressman Gerry Sikorski from Minnesota.

[Testimony resumes on p. 26.]

[The text of H.R. 3400 follows:]

98TH CONGRESS
1ST SESSION
H. R. 3400

To amend the Clean Air Act to control certain sources of sulfur dioxides and nitrogen oxides to reduce acid deposition and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

JUNE 23, 1983

Mr. SIKORSKI (for himself, Mr. WAXMAN, and Mr. GREGG) introduced the following bill; which was referred to the Committee on Energy and Commerce

---

A BILL

To amend the Clean Air Act to control certain sources of sulfur dioxides and nitrogen oxides to reduce acid deposition and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "National Acid Deposition Control Act of 1983".

FINDINGS AND PURPOSES

SEC 2. (a) The Congress finds that—

(1) The long-range transport of sulfur dioxides and nitrogen oxides and their transformation products is an interstate, national, and international problem.

(2) The deposition of acid compounds from the atmosphere is causing and contributing to widespread long-term ecosystem degradation in many parts of the Nation.

(3) The problem of acid deposition is nationwide in scope and of national and international significance and cannot be addressed adequately without Federal intervention.

(4) Current levels of emissions of sulfur dioxides and nitrogen oxides from existing sources as well as increased emissions from new sources present a threat to public health and welfare and the environment in States and countries other than those in which the air pollutants are emitted.

(5) The principal source of the acid compounds in the atmosphere and their precursors is the combustion of fossil fuels.

(6) Oxides of nitrogen from mobile sources causes and contributes to acid deposition in many parts of the Nation.

(7) Reduction of the total atmospheric loading of sulfur dioxides and nitrogen oxides will mitigate the

damage to affected ecosystems and enhance protection of public health and welfare and the environment.

(8) More effective regulation of the intrastate and interstate transport of sulfur dioxides and nitrogen oxides is needed in order to protect the health and welfare of citizens of affected States and the economic growth opportunities of affected States.

(9) Control strategies and technology for precursors to acid deposition exist now that are economically feasible.

(10) Current and future generations of Americans will be adversely affected by delayed action, so that efforts to remedy the problem should commence now.

(11) The installation of additional control technology for a number of existing electric utility plants would provide an effective and verifiable means to reduce emissions of sulfur dioxides; and

(12) A nationwide fee system is necessary to provide funding for a portion of the capital cost of the required technology so as to lessen utility rate increases and avoid economic disruption or increased unemployment.

(b) The purposes of this Act are—

(1) to initiate a program to protect health and welfare and the environment from any actual or poten-

tial adverse effect caused by ambient concentrations and deposition of sulfur dioxides and nitrogen oxides and the products of atmospheric transformation of these air pollutants;

(2) to enhance the ability of States to protect the public health and welfare and the environment of their citizens from air pollution originating in other States;

(3) to ensure that current employment will not be jeopardized as a result of the effort to control acid deposition; and

(4) to spread the costs of controlling acid deposition so that no region of the Nation bears an unfair burden.

TITLE I—ACID DEPOSITION CONTROL AND ASSISTANCE PROGRAM

SEC. 101. Title I of the Clean Air Act is amended by adding the following new part at the end thereof:

"PART E—ACID DEPOSITION CONTROL

"PURPOSE OF PART

"SEC. 181. (a) The purpose of this part is to decrease sulfur dioxide emissions in the 48 contiguous States by requiring certain electric utility plants and other sources to reduce, by 1993, their rates of sulfur dioxide emissions to rates which (if achieved by those sources in 1980) would have resulted in total emissions from such sources

10,000,000 tons below the actual total of sulfur dioxide which those sources emitted in 1980. Such reduction shall be achieved through—

"(1) a program under subpart 1 consisting of direct federally mandated emission limitations for 50 of the largest emitters of sulfur dioxide; and

"(2) a program under subpart 2 consisting of State plans to provide for such reductions in the emission rates of other existing sources as may be necessary to achieve the remaining portion of such 10,000,000 ton reduction.

Ninety percent of the capital costs of continuous emission control technology used for the purpose of such programs shall be funded through a fee on the generation of electric energy as provided in subpart 3.

"(b)(1) Nothing in this part shall be construed to limit emissions from any new (or modified) electric utility unit, to limit emissions from any other new source of sulfur dioxide, or to limit emissions from any oil or gas fired electric utility unit or other source which changes the fuel which such unit or plant used in 1980.

"(2) Nothing in this part shall be construed to prevent any existing electric utility plant or any other existing stationary source of sulfur dioxide from at any time increasing plant utilization above 1980 levels.

"(3) Nothing in this part shall be construed to require any State to reduce emissions under subpart 2 of this part to take into account emissions increases attributable to units or sources referred to in paragraphs (1) and (2).

"DEFINITIONS

"SEC. 182. As used in this part, the terms:

"(1) 'New' and 'modified' when used with respect to an electric utility unit or other source means an electric utility unit or other source which commenced construction (or modification) after December 31, 1980, and which is subject to new source performance standards under section 111.

"(2) 'Commenced' when used with respect to construction or modification has the same meaning as when used in section 111.

"(3) 'Fossil fuel fired electric utility generating plant' means all of the fossil fuel fired electric utility steam generating units owned or operated by an electric utility which are located on one or more contiguous or adjacent properties.

"(4) 'Steam generating unit', 'electric utility', and 'fossil fuel' have the same meanings as provided in regulations under section 111 applicable to electric utility steam generating units for which construction is commenced after September 18, 1978 (40 CFR 60.41a).

"(5) 'Btu' means a British thermal unit.

"(6) 'Technological system of continuous emission reduction has the meaning provided by section 111(a)(7).

"(7) 'Sulfur dioxide' when used with respect to emissions means total sulfur emissions expressed as sulfur dioxide emissions.

"RELATIONSHIP TO OTHER REQUIREMENTS

"SEC. 183. Nothing in this part shall be construed to affect or impair the requirements of section 110 (or of any applicable implementation plan) or of any other section of this Act, except that any stationary source which is subject to any such requirements may also be subject to additional requirements under this part.

"Subpart 1—Retrofit Technology for 50 Facilities

"FEDERALLY MANDATED EMISSION REDUCTIONS

"SEC. 185. (a)(1) The Administrator shall identify each fossil fuel fired electric utility generating plant which emitted sulfur dioxide during the calendar year 1980 at an annual average rate equal to or in excess of 3 pounds per million Btu.

"(2) Not later than 2 months after the date of the enactment of this part, the Administrator shall publish in the Federal Register a list of the 50 plants among those identified under paragraph (1) which have the largest total emissions of sulfur dioxide during the calendar year 1980 and shall notify the owner or operator of each plant on such list.

"(3) Not later than 4 months after such date of enactment, and after notice and opportunity for comment, the Administrator shall promulgate, and publish in the Federal Register, a final list of the 50 plants among those identified under paragraph (1) which the Administrator determines had the largest total emissions of sulfur dioxide during the calendar year 1980.

"(b)(1) Not later than January 1, 1985, the owner or operator of each plant listed under subsection (a)(3) shall submit to the Administrator a compliance schedule under this section, including increments of progress. Within 1 year after the submission of a compliance schedule, and after notice and opportunity for hearing, the Administrator shall approve or disapprove the schedule.

"(2) If a compliance schedule is not submitted on or before the date required under paragraph (1) for any plant listed under subsection (a)(3), if a schedule submitted under paragraph (1) for such plant is not approved by the Administrator before January 1, 1986, the Administrator shall promulgate a compliance schedule, including increments of progress, for such plant on January 1, 1986. If, after January 1, 1986, the Administrator determines that any previously approved compliance schedule, including the increments of progress in such schedule, is inadequate to meet the requirements of subsection (c), the Administrator shall require submission of, or promulgate, a modified compliance schedule, including increments of progress, for such plant. Each schedule which is approved or promulgated by the Administrator under this subsection shall be published in the Federal Register.

"(c)(1) Each compliance schedule under this section shall provide that—

"(A) a technological system of continuous emission reduction shall be used for each steam generating unit in the fossil fuel fired electric utility generating plant concerned, and

"(B) sulfur dioxide emissions from such plant for the calendar year 1990 and for each calendar year thereafter shall not exceed—

"(i) 1.2 pounds per million Btu heat input and 10 percent of the total annual sulfur dioxide emissions during the calendar 1980 (90 percent reduction), or

"(ii) 0.6 pounds per million Btu and 30 percent of the total annual sulfur dioxide emissions during the calendar 1980 (70 percent reduction).

Compliance by the plant with such emission limitation shall be determined in the same manner as provided for determination of compliance with regulations under section 111 applicable to electric utility steam generating units for which construction is commenced after September 18, 1978, except that (I) such regulations shall be applied on a plantwide basis (including all fossil fuel fired electric utility units which comprise the plant) and (II) compliance with the 1.2 pounds per million Btu and 0.6 pound per million Btu rates set forth in clauses (i) and (ii) shall be determined on the basis of average annual emissions of the plant in lieu of the 30-day rolling average which is applicable to each steam generating unit under such regulations.

"(2) The compliance schedule under this subsection shall provide that—

"(A) contracts shall be entered into for the purchase and installation of the technological systems of continuous emission reduction not later than January 1, 1988;

"(B) such systems shall be installed and in operation not later than January 1, 1990; and

"(C) the emission limitation required under paragraph (1) shall be achieved for each calendar year after 1989.

"(d) For purposes of sections 113, 114, 116, 120, and 304 of this Act, a compliance schedule under this section (including any increment of progress set forth in such schedule) shall be treated as an emission limitation.

"PAYMENT FOR CAPITAL COSTS OF CONTROL

"SEC. 186. (a) From the fund established under subpart 3 of this part, the Administrator shall make available to each owner or operator of a plant which is subject to a compliance schedule under section 185 such sums as the Administrator deems necessary to pay for 90 percent of the costs of the construction and installation of the technological system of continuous emission reduction necessary to comply with the emission limitation applicable under section 185(c)(1).

"(b) The Administrator, after consultation with the Secretary of the Treasury, shall promulgate regulations under which—

"(1) no payment may be made under this section to a utility for any costs unless the Administrator determines that, under applicable rates schedules, the full amount of such payment will be used to reduce those electric rate increases (payable by customers of the utility) which otherwise would result from the construction and installation concerned; and

"(2) such payments shall be made at such times as will minimize any electric rate increases for customers of the utility.

"Subpart 2—State Plans for Additional Emission Reductions

"CALCULATION OF STATE SHARES

"SEC. 191. (a) Not later than 4 months after the date of the enactment of this part, for each of the 48 contiguous States, the Administrator shall compute a State share of the 10,000,000 ton reduction in annual emissions of sulfur dioxide referred to in section 181(a).

"(b) The State share for each such State shall be a percentage of 10,000,000 tons determined by dividing the amount computed under paragraph (1) by the amount computed under paragraph (2).

"(1) The Administrator shall compute the total annual emissions of sulfur dioxide during the calendar year 1980 from fossil fuel fired electric generating plants which are located in the State and which, during the calendar year 1980, emitted sulfur dioxide at an annual average rate in excess of 1.2 pounds per million Btu.

"(2) The Administrator shall compute the total annual emissions of sulfur dioxide during the calendar year 1980 from all fossil fuel fired electric generating plants which are located in the 48 contiguous States and which, during the calendar year 1980, emitted sulfur dioxide at an annual average rate in excess of 1.2 pounds per million Btu.

"(c) The Governors of any two or more States may (by agreement) reallot among agreeing States the State share of two or more agreeing States if, under such reallotment, the total reduction in annual emissions of sulfur dioxide from all stationary sources subject to emission limitations under section 193(a) is equal to or greater than the total reduction in annual emissions of sulfur dioxide from such sources which would be required under this part in the absence of such reallotment.

"SUBMISSION AND APPROVAL OF STATE PLANS

"SEC. 192. (a) On or before June 1, 1985, each State for which a State share is calculated under section 191 shall submit a plan to the Administrator under this section.

"(b) Within 6 months from the date of submission of a State plan under this section, the Administrator shall approve the plan if he determines that the plan contains provisions, including enforceable increments of progress, adequate to assure that the emission limitations required under section 193 will be achieved by January 1, 1993.

"(c) If a State plan is submitted under this section on or before June 1, 1985, and the Administrator disapproves such plan, the Administrator shall notify the State of the reasons for such disapproval and the State may resubmit such plan within 6 months from the date on which such notice is provided. If no State plan has been submitted under this section on or before June 1, 1985, or if no State plan has been approved by the Administrator on or before January 1, 1988, the Administrator shall promulgate a State plan under this section for such State on January 1, 1988.

"EMISSION LIMITATIONS IN STATE PLANS

"SEC. 193. (a) The plan for each State required to submit a plan under section 192 shall provide for emission limitations applicable to any stationary sources in the State for which the actual annual sulfur dioxide emission rates have been calculated by the Administrator for the calendar year 1980, other than a source which is one of the 50 electric utility plants subject to subpart 1 of this part. The emission limitations for each stationary source subject to the State plan shall establish an allowable average annual sulfur dioxide emission rate for the source. The allowable average annual sulfur dioxide emission rates for such sources shall be established at such levels that—

"(1) if each source emitted sulfur dioxide at the allowable rate during the calendar year 1980, and

"(2) a credit is applied in accordance with subsection (b), the total reduction in actual annual emissions of sulfur dioxide in the State during the calendar year 1980 would equal the State share determined under section 191.

"(b) A credit under this subsection shall be applied under subsection (a)(2) for each State in which there is located one of the 50 electric utility plants subject to subpart 1 of this part. The credit shall be equal to the total annual reduction in emissions of sulfur dioxide which would have been achieved in that State during the calendar year 1980 if the plants in that State which are subject to subpart 1 were each in compliance with the emission limitations under subpart 1 during the calendar year 1980.

"(c) The State plans under this subsection may provide for compliance with the emission limitations applicable under such plans through the use of a technological system of continuous emission reduction or any other requirements which the State deems appropriate to reduce the sulfur dioxide emission rate of any stationary sources for which the actual annual sulfur dioxide emission rates have been calculated by the Administrator for the calendar year 1980 (other than an electric utility plant subject to subpart 1 of this part).

"(d) Each requirement of a State plan approved or promulgated by the Administrator under this section shall be treated, for purposes of sections 113, 114, 116, 120, and 304 as a requirement of an applicable implementation plan.

"FINANCIAL ASSISTANCE FOR COMPLIANCE WITH STATE PLANS

"Sec. 194. From the fund established under subpart 3 of this part, the Administrator shall make available to each owner or operator of an electric utility generating plant which is subject to requirements under a State plan approved or promulgated under this part such sums as the Administrator deems necessary to pay for 90 percent of the costs of the construction and installation of any technological system of continuous emission reduction (as defined in section 111(a)(7)) which is necessary to comply with such requirements. Payments under this section shall be subject to the regulations under section 186(b).

"Subpart 3—Acid Deposition Control Fund

"ESTABLISHMENT OF FUND

"Sec. 195. (a) There is established in the Treasury of the United States a trust fund to be known as the 'Acid Deposition Control Fund' (hereinafter in this subpart referred to as the "Fund"), consisting of such amounts as may be transferred to such Fund as provided in this section.

"(b) There are hereby credited, out of any money in the Treasury not otherwise appropriated, to the Fund amounts determined by the Secretary of the Treasury (hereinafter in this title referred to as the 'Secretary') to be equivalent to the amount received in the Treasury under section 196.

"(c) Amounts in the Fund shall be available only for purposes of making expenditures which are described in subpart 1 and subpart 2 of this part. If amounts available in the fund are inadequate to make all expenditures which are required to be made by the Administrator under such subparts, the Administrator shall make such expenditures in accordance with the following priorities:

"(1) The Administrator shall first make expenditures required under section 186 and, if amounts in the fund are inadequate to make all expenditures required under such section 186, the available amounts shall be allocated first to the facilities which first applied for payment under such section 186.

"(2) The Administrator shall next make expenditures required under section 194 and, if amounts in the fund are inadequate to make all expenditures required under such section 194, the available amounts shall be allocated first to the facilities which first applied for payment under such section 184.

"(d)(1) The amounts appropriated by subsection (b) shall be transferred at least monthly from the general fund of the Treasury to the Fund on the basis of estimates made by the Secretary of the amounts referred to in such subsection (b). Proper adjustments shall be made in the amount subsequently transferred to the extent prior estimates were in excess of or less than the amounts required to be transferred.

"(2)(A) The Secretary shall be the trustee of the Fund, and shall report to the Congress for each fiscal year ending on or after September 30, 1984, on the financial condition and the results of the operations of such Fund during such fiscal year and on its expected condition and operations during the next 5 fiscal years. Such report shall be printed as a House document of the session of the Congress to which the report is made.

"(B) It shall be the duty of the Secretary to invest such portion of such Fund as is not, in his judgment, required to meet current withdrawals. Such investments shall be in public debt securities with maturities suitable for the needs of such Fund and bearing interest at rates determined by the Secretary, taking into consideration current market yields on outstanding marketable obligations of the United States of comparable maturities. The income on such investments shall be credited to, and form a part of, such Fund.

"FEES

"SEC. 196. (a) Under regulations promulgated by the Administrator, there shall be imposed a fee of 1 mill for each kilowatt hour of electric energy generated in the contiguous 48 States by an electric utility and 1 mill for each kilowatt hour of electric energy imported into the contiguous 48

States. The fee shall not apply with respect to electric energy which is—

"(1) used at the electric generating facility concerned, or

"(2) generated by a nuclear generating facility.

The fee shall take effect with respect to electric energy generated, or imported, after December 31, 1984. The fee shall cease to apply on the earlier of—

"(1) December 31, 1995, or

"(2) the date on which all payments required to be made under subparts 1 and 2 of this part have been made.

The Administrator may terminate the fee at an earlier date if, under estimates made by the Administrator, sufficient funds have been collected to fund 100 percent of the payments which are to be made under subparts 1 and 2 of this part.

"(b) The regulations of the Administrator under subsection (a) shall be promulgated not later than 6 months after the date of the enactment of this part and shall set forth the time and manner required for payment of the fee imposed under subsection (a) and the information required to be reported in connection with the payment of such fee.

"(c)(1) Any electric utility (or importer of electric energy) which fails or refuses to pay any amount of a fee imposed under subsection (a) or which fails or refuses to file any report or other document required by the Administrator in connection with the imposition of such fee shall, in addition to liability for any unpaid amount of such fee (and interest on any such unpaid amount), be liable for a civil penalty of $50,000 for each day during which such failure or refusal continues. Any person who makes any false or misleading statement in any such report or other document required by the Administrator in connection with the imposition of such fee shall be liable for a civil penalty of $50,000.

"(2) The Administrator shall bring a civil action against any electric utility (or importer) which fails or refuses to pay any amount of a fee imposed under subsection (a), fails or refuses to file any report or other document required by the Administrator in connection with the imposition of such fee, or makes any false or misleading statement in any such report or other document required by the Administrator in connection with the imposition of such fee. Civil actions under this subsection shall be brought in the same manner and in accordance with the same procedures as are applicable to civil actions brought under section 113(b) against any person who violates any requirement of an applicable implementation plan.

"(d) Any electric utility (or importer of electric energy) which knowingly fails or refuses to pay any amount of a fee imposed under subsection (a) or which knowingly fails or refuses to file any report or other document required by the Administrator in connection with the imposition of such fee shall, in addition to civil liability under subsection (c), be subject to a criminal penalty of $100,000.".

CONFORMING AMENDMENTS

SEC. 102. (a) Section 113(a)(3) of the Clean Air Act is amended by inserting "or is in violation of any requirement in effect pursuant to subpart 1 of part E," after "inspections, etc.)".

(b) Section 113(b) of the Clean Air Act is amended by inserting the following immediately after paragraph (5): "Whenever any person violates any requirement in effect pursuant to subpart 1 of part E, the Administrator may commence a civil action for permanent or temporary injunction or to assess and recover a civil penalty of not more than $25,000 per day of violation, or both.".

(c) Section 113(c)(1)(C) of the Clean Air Act is amended by inserting "or violates any requirement in effect pursuant to subpart 1 of part E," before "or".

(d) Section 307(b)(1) of the Clean Air Act is amended by inserting ", any final action taken by the Administrator under part E of title I" after "120" in the first sentence thereof.

TITLE II—CONTROL OF NITROGEN OXIDE EMISSIONS

REVISIONS OF NEW SOURCE PERFORMANCE STANDARD

SEC. 201. Section 111 of the Clean Air Act is amended by adding the following new subsection at the end thereof:

"(k) The Administrator shall revise the standards of performance for emissions of nitrogen oxides from electric utility steam generating units which burn bituminous or subbituminous coal. Such revised standards shall prohibit the emission of nitrogen oxides from such units at a rate which exceeds—

"(1) 0.30 pounds per million Btu's, in the case of subbituminous coal; and

"(2) 0.40 pounds per million Btu's, in the case of bituminous coal

based on a 30-day rolling average. Such revised standard shall take effect with respect to units which commence construction after the date of the enactment of this subsection. As used in this subsection, the terms 'electric utility steam generating unit', 'bituminous coal', and 'subbituminous coal' have the same meanings as when used in 40 C.F.R. part 60, subpart Da, as in effect on January 1, 1983.".

EMISSIONS FROM MOBILE SOURCES

SEC. 202. (a) Section 202 of the Clean Air Act is amended by adding the following new subsection at the end thereof:

"(g) Effective with respect to vehicles and engines manufactured during and after the model year 1986, the regulations under subsection (a) applicable to emissions of oxides of nitrogen from trucks and truck engines the gross vehicle weight of which does not exceed 8,500 pounds shall contain standards which provide that such emissions may not exceed the number of grams per vehicle mile specified in the following table:

Gross Vehicle Weight	**Emission Standard**
Not in excess of 6,000 lbs	1.2
In excess of 6,000 lbs	1.7

Effective with respect to vehicles and engines manufactured during and after the model year 1986, the regulations under subsection (a) applicable to emissions of oxides of nitrogen from trucks and truck engines the gross vehicle weight of which exceeds 8,500 pounds shall contain standards which provide that such emissions may not exceed 4.0 grams per brake horsepower-hour. Nothing in subparagraph (B) or (E) of subsection (a)(3) shall apply to any standard established under this subsection.".

(b) Section 202(a)(3)(A)(ii) is amended by inserting "and except as otherwise provided in subsection (g)," after "(E)".

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Mr. Sikorski. Thank you, Mr. Chairman. If we would compress and put on some imaginary scale the emissions of sulfur dioxide-nitrogen oxide on a daily basis that are shot into the air over the North American Continent, they would total 170,000 tons on a daily basis. That is the equivalent of over 4,000 railroad boxcars full of the acid that come down in the form of acid precipitation.

Acid rain has been called the most serious environmental threat to the North American Continent. Environmentalists and sports men and women, scientists, now even the Reagan administration to some degree all have agreed that something needs to be done to control acid rain. We have already lost hundreds of lakes, thousands of trees, and endangered millions of acres of forest and cropland. New York and the Northeastern part of the United States is especially vulnerable and stand to lose thousands of lakes, millions of acres of land, and risk its agricultural, forestry, tourism, and sports fishing industries.

Jobs, skyrocketing utility rates, and environmental concern are part of the mix that we discuss in terms of acid rain control legislation. The best solution, I believe, to resolve the dilemma of both protecting jobs and the environment, is for national costsharing.

H.R. 3400 is the first acid rain control program that offers a national solution to a national problem. It would add a 1 mill fee, that is one-tenth of 1 percent for each electric kilowatt generated. For an average American family, it would mean an extra 50 to 75 cents a month on the utility bill; for an average New York family, $1 a month.

The money collected would pay up to 90 percent of the one-time cost of installing scrubbers at the 50 dirtiest powerplants. It would cut sulfur dioxide emissions by 7-million tons and save thousands of jobs. Further the bill would totally remove a total of 14-million tons of the components of acid rain from the air by 1995.

In contrast, some have suggested an emissions tax plan that would be levied against consumers of electricity as well as cars and trucks and other products of a coal-fired process. This approach is attractive as well because it theoretically is a sound environmental policy and might save some Minnesota consumers, maybe some New York consumers, a few cents a month more than other proposals.

In reality it may well cost New York and Minnesota consumers more per month. And while the "let other people clean up" concept sounds good in theory, in practical terms it is unenforceable, it is costly, and probably means that no meaningful acid rain legislation will be enacted because it does not have votes.

Too many Congressmen support the utility's position of doing nothing and Congressmen from the industrial Midwest will not vote to put their constituents out of work or their senior citizens out of their homes with 50-percent utility rate increases.

If we delay, righteously telling out-of-State polluters that we have done our work and they should do theirs, we will do nothing to stop acid rain. We will just as effectively destroy the precious economic environmental resources of New York and all of America as those who oppose any action.

None of us have clean hands. There is not a State in this country that does not pollute with SO_2 and NO_x emissions. Utilities in all of our States pump billions of pounds of SO_2 and NO_x into our skies every single day of the year. Further, we are all part of a national utility grid that relies on dirty powerplants around the country to supplement in-State utility generation.

Given my druthers, I would like to have everyone but Minnesotans and maybe New Yorkers pay for acid-rain control. I would like to reduce sulfur dioxide-nitrogen oxide emissions by more more than 14-million tons required in H.R. 3400. I would like to begin immediately and I would like to magically revive Lake Placid and the lakes in northern New York, restore the Statue of Liberty and other public buildings and return the forests to their former beauty. But given the realities of Congress, H.R. 3400 is the best acid rain bill that we will be able to get through. It is a fair bill. It asks those that contribute to the emissions, participate in the cleanup. It spreads the cost of cleanup so that no region is burdened with skyrocketing utility rates. It saves a quarter of a million jobs. But best of all, it has the greatest chance of passage, so that cleanup efforts, which have been delayed for too many years, can begin now and Minnesota, New York, and all of America will be safe from an acid rain disaster.

Thank you, Mr. Chairman. I congratulate you for beginning this process to hopefully a good, strong acid rain bill.

Mr. WAXMAN. Thank you, Mr. Sikorski.

Our subcommittee is very fortunate to have two members from New York City and the State of New York. First I want to call upon a man who has done extensive work on acid rain concerns, as chairman of his own subcommitee on the Science and Technology Committee. He is chairman of the Subcommittee on Natural Resources and Environmental Research—Congressman James Scheuer.

Mr. SCHEUER. Thank you, Mr. Chairman. I want to congratulate you and our colleague from Minnesota for having crafted a very artful bill. It faces up to the political realities of putting together a majority of the House and the Senate, and does so in an extraordinarily sophisticated and politically artful manner. You are both to be congratulated. And I congratulate the chairman for coming to this Empire State, this great Empire State and holding a hearing, where we can show that problems are so dramatic and so tragic and so pitiful.

Frankly, Mr. Chairman, this is one hearing that I would just as soon had not ever taken place. I wish there had not been any necessity for this hearing. Many Members of Congress in the closing months of last year and the opening months of this year, complained incessantly about the way that Mr. Watt and Mrs. Gorsuch, whether faithfully or not, were carrying out the President's policies and degrading our environment, degrading our health. And finally we thought we had brought about some changes, and we were delighted when Mr. Ruckelshaus was appointed Administrator about 8 or 9 months ago, a man of outstanding ability, integrity and proven commitment to the environment, beyond any question.

But we did raise an early warning signal at that time. And we did say, I and many others, that if Mr. Ruckelshaus did not have a commitment from the President for funding for environment research, for environment programs and for enforcement of our environment laws, then it was all blue smoke and mirrors. Then it was a sham. And we assumed that he had a commitment. But here we are 8 or 9 months later with the problems of acid rain, convincing scientists who have been reluctant over the years, convincing them that now we know enough to do something. Here we are with the President still saying no. Here we are with Bill Ruckelshaus still trying to get from the cabinet council on environment, some indication that they are willing to take the first feeble step forward.

And he was trying to get some indication of support from the President in March. Nothing happened. In April and May nothing happened. In June, July, August—nothing happened. September, October, and November—nothing happened. And here we are with not one shred of evidence that the President and that this administration are ready to put their money where their mouth was.

I was present at Bill Ruckelshaus swearing-in last February or March, and the President interrupted Ruckelshaus' acceptance speech to say how committed he was to acid rain and how he was determined to do something. But here almost a year later—and many, many efforts later by Bill Ruckelshaus to get the faintest glimmer of support from the administration—here we are presumably having a hearing on why the administration has not moved, and hopefully to get some support for this bill, bipartisan support for this bill, that we will pass and send to the President for his signature.

I want to make a tribute at this point to one of the great institutions in our country, that so-called other body, the U.S. Senate. Even though the Senate is controlled by Republicans, they have acted with dedication, commitment and with responsibility toward our environment and our health. And none of the Senate committee chairmen who have responsibility and authority in this field have acted in any other way than concern for the issues, nonpartisan, bipartisan concern for the issues, and the determination to make some progress.

So I pay tribute to you, Mr. Chairman, and to the sponsor of this bill, Mr. Sikorski. I am delighted our Governor is here to show the concern about this issue from top to bottom in the State of New York, and I look forward to hearing his testimony.

Mr. WAXMAN. Thank you very much, Mr. Scheuer. Certainly Mr. Ruckleshaus ought to take your words very seriously, because you are credited by most of us with bringing down the previous administrator of the Environmental Protection Agency.

Mr. SCHEUER. You honor me too much.

Mr. WAXMAN. One of the outstanding environmental leaders in the House and one we are very fortunate to have on our subcommittee is Congressman Richard Ottinger. He is cosponsor of this bill, and will be pushing for increases in the pollution reductions called for that cause acid rain. I would like to call upon him at this time—Mr. Ottinger.

Mr. OTTINGER. Thank you, Mr. Chairman. Let me congratulate you for having the wisdom of holding the first hearings on this tremendously important legislation in our great State of New York.

We probably suffered greater damage than any other area in the country attributable to acid rain, the Great Lakes and the Adirondacks having suffered incredible devastation because of this phenomena. I would also like to welcome our good Governor who in this field, as in so many others, has shown tremendous leadership. I see our good Senator is here who has been carrying the ball in the Senate. If Republican Senators do good things, it is only because they have the inspiration and Pat Moynihan spurred them on.

The problems of acid rain and its destruction of lakes and forests, agricultural products, its damage to buildings, has been pretty well documented. But perhaps the greatest danger of acid rain has yet to be demonstrated scientifically, and that is the threat to human health. Many historians believe that the decline of the Roman Empire was due in large part to chronic lead poisoning from lead-lined cisterns used at the time.

We have a situation today that closely parallels that of Ancient Rome. Acid rain is causing metals from soils and from underground pipes to be leached into our water supplies and to be taken up by plants and agricultural products grown in these soils. This could have very serious effects on human health. It is becoming increasingly apparent that acid rain releases normally inactive chemicals found in soil. These newly released chemicals, like aluminum, then travel up into plants or are leached in the water supplies, The plants grown in this soil or the fish consumed from the lakes are contaminated.

Acid rain is responsible, according to a recent EPA report, in increased lead and possible cadmium concentrations in drinking water supplies. This is because of the increased corrosidity of lead pipes as a result of acid rain. Little by little, like the Ancient Romans, we are increasing the toxic concentration of chemicals in our bodies. I am reminded of that great line from David Brower, from Friends of the Earth, with respect to DDT, which he said that mother's milk is so contaminated with DDT, at this point, that it would not be allowed to travel in interstate commerce in any other container.

I think we are facing the same kind of a situation with respect to toxic metals that are being released in an alarming degree through the operation of acid rain.

A recent National Academy of Science report indicated that substantial damage reduction could be obtained if we reduced sulfur and nitrogen emissions by one-half. That is what this legislation is designed to do. I congratulate Mr. Sikorski and Mr. Waxman for having crafted a piece of legislation that makes a meaningful dent as prescribed by the National Academy of Science study in this problem and does so in a way that is both politically and humanitarianly feasible.

We could not do what seems to be the thing that apparently makes the most sense, and that is just put the burden on those who pollute. The ideal thing would be just to prohibit pollution and put the burdens on the pollutors. But in the Midwest, where so much of this pollution comes from, is the most devastated part of the country today economically, and to do so would not be a humanitarian solution nor a politically feasible solution.

This legislation by spreading the cost, and it is in a large sense a national responsibility for having allowed this to happen, creates a sensible and I think a politically feasible solution.

Congressman Norman D'Amors in the New England caucus developed similar legislation and I think that has some improvements in it over that originally drafted, and I hope those features of it will be considered as I am sure they will by the subcommittee.

I have an amendment which I have prepared as our good chairman has indicated, that would increase the amount by which we would reduce sulfur emissions to a full 12 million tons by 1995. That would meet the objectives of the National Academy of Science. And I thank the chairman for his indication of the consideration of that amendment as well.

I think this is as important a subject as Congress has to deal with. I share the concerns expressed by my friend from New York, Mr. Scheuer, that Mr. Ruckelshaus has not been permitted to come forward with an administration plan. I think that our subcommittee and the full committee will surely proceed whether or not the administration endorses a particular program. And I am just delighted that we are getting started, as I said, that we are getting started here in New York. Thank you.

Mr. WAXMAN. Thank you very much, Mr. Ottinger.

I would at this time to insert the statement of Representative Hamilton Fish, Jr., into the record.

STATEMENT OF HON. HAMILTON FISH, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. Chairman, my testimony today has one purpose: to add my voice to those testifying today of the need for action to reduce the prospects of continued deterioration of our forests and lakes. It is long past the time that Congress act to implement a policy to address the issue of acid deposition. I hope that our testimony today will have an effect on bringing to the floor a bill that addresses the concerns of all regions in this country, and is effective in reducing the production of agents such as sulfur and nitrogen oxides that acidify precipitation and destroy our lakes and forests.

How large is the problem? The effects of acid rain can be found thoughout the United States and Canada. The rainfall over much of North America is abnormally acidic. Rainful in the Eastern United States and Canada is 30–40 times more acidic than unpolluted rain. This has drastic consequences to the Nation's lakes, forests, streams, crops, and buildings.

This acid fall has already caused extensive damage—thousands of lakes and streams have been so acidified that fish can no longer live in them. The National Academy of Sciences in 1981 warned that unless acid rain were controlled, the number of affected lakes would double by 1990. The problem is not limited to the Northeast. According to surveys by EPA and OTA, lakes and streams in 34 States are either vulnerable to or have already been damaged by acid rain.

The effects of acid rain on forests could be even far more extensive and irreversible than the damage to lakes and streams. Forests exhibiting stunted growth and "die-back" are increasingly found. Most of the usual causes such as disease, insects, population cycles, and climate have been ruled out. Evidence that acid rain is causing forest damage is accumulating at a rapid rate.

In addition, evidence exists that acid rain can reduce the yield and marketability of important crops, and affect our drinking water supplies. Increases in acidity of drinking water, and in the amounts of metals found there can be expected from increased acid rain. Also, corrosion of our Nation's infrastructure is causing extensive damage. The National Academy of Sciences estimated in 1981 that $2 billion in damage is done to buildings and monuments every year. Total costs to the United States are over $5 billion, annually.

What causes acid rain? Simply put, the effluents of our advanced industrial age. The prime causative agents are sulfur and nitrogen oxides produced in great amounts of our electric utilities, industrial facilities, and motor vehicles. The National Academy of Sciences, in its 1981 report on the ecological consequences of fossil Fuel Combustion, stated, "The control of emissions of sulfur and nitrogen oxides from fossil fuel is necessary to halt the acidification of sensitive aquatic ecosystems". They further found that "the circumstantial evidence for the role of powerplant emissions in the production of acid rain is overwhelming."

In addition to the Academy's 1981 report, two major scientific studies were released in June of this year that concluded that available scientific evidence does justify action to control acid rain now. These reports were issued by the National Academy of Sciences and the Office of Science and Technology policy. The findings of these studies are comprehensive and I won't begin to list them here. What is important is that these reports mark a turning point in our consideration of acid rain. No longer should the debate be centered upon whether we have enough evidence to act on. Rather we should be discussing what the best type of control program should be, and how it should be implemented. The conclusion that policy makers should draw from these reports are clear—action should be taken now to reduce emissions of sulfur and nitrogen oxides in order to protect our natural resources.

As a cosponsor of H.R. 3400, and of H.R. 4404, I would like to complement the chairman and the committee members for holding these hearings on legislative proposals to curb acid rain. Let us hope that our efforts in this Congress will come to fruition and we will begin the long process of protecting our resources from further degradation and repairing much of the damage that has already occurred.

Mr. WAXMAN. Governor Cuomo, we are delighted that you have made time out of your busy schedule to be our, leadoff witness at this hearing in New York on the problem of acid rain. We want to hear from you. We are going to hear from others as well, Democrats and Republicans, who are leaders from your State in this area. I would like to call upon you at this time for your presentation to us.

STATEMENT OF MARIO M. CUOMO, GOVERNOR, STATE OF NEW YORK

Governor CUOMO. Thank you, Mr. Chairman, and welcome to New York State. We are delighted to greet you and Congressman Scheuer and Congressman Ottinger, who I think you referred to as being from New York City, and we would be proud to have him, but he is a little bit north of here. And Congressman Sikorski and Mr. Dodson, we are pleased to have you in this great city. We regret, frankly, that logistics made it impossible for us to have this hearing at Lake Placid where I personally would have preferred it, and I suspect most of us would have. Then we could have seen for ourselves and vividly the kind of strength and beauty that has been desecrated by this failure of intelligence and will that we call acid rain.

I am pleased to have with me our commissioner of the Department of Environmental Conservation, Hank Williams, and Frank Murray of my staff.

Much of what you have said already, as a committee, we agree with, of course, as I think most New Yorkers who are familiar with the situation would. For emphasis, however, let me reiterate some of the basic predicates here.

Acid rain is perhaps the most severe challenge facing New York's environment, and it is one that we cannot as a State solve alone. The problem arises in large measure outside of our borders. And although we are doing all in our power to correct the causes of acid rain and to repair the damage that has already been inflicted, a full and final resolution can only be achieved by the Federal government.

By holding these hearings, you are drawing attention to this fact, helping us to put the question of acid rain in the national, indeed even international, context, and thereby promote a Federal response.

The people of New York are grateful for this. For almost a decade now, we have witnessed the mounting effects of acid rain on our forests, our wilderness areas, and our parks. The greatest damage has been in the rugged and magnificent Adirondack Mountain region where over 200 lakes and ponds are contaminated, too contaminated indeed to support any fish, and hundreds more are in danger of becoming so. The damage is not confined to the Adirondacks.

The Hudson highlands and the Catskill Mountains have also suffered. And across the entire Northeast, lakes and mountain ranges and forests, precious resources, preserved across generations with great effort and at great expense, are now being put in jeopardy.

In purely economic terms, estimates of the damage done by acid rain to our environment ranged as high as $1.6 billion and yet the damage inflicted by acid rain is potentially even far greater than this. Besides threatening the integrity of our landscape or the future of our wildlife, as Congressman Ottinger has pointed out, acid rain threatens our health as well.

In parts of upstate New York, it is affecting the drinking water. Residents of these areas have been admonished to flush their domestic water supply lines before they drink from them. Because we are so directly and measurably touched by acid rain, New York has not been allowed the luxury of a long leisurely debate over where acid rain comes from and whether it can be diminished or controlled and what measures should be taken to correct it. It is clear to us where the problem comes from, and as far as we contribute to it, we have moved forcefully to stop it.

I think it was Congressman Sikorski who said that none of us have clean hands, and that is correct. Some of us, I think, have done more scrubbing than others. And surely that includes New York.

Since 1968 New York has reduced sulfur dioxide emissions by approximately 50 percent or 1 million tons. During a period of growth in electric power generation, we have applied and enforced some of the strongest air pollution control regulations in the United States. We have imposed stringent environmental constraints on two separate coal conversion applications. In one the State imposed the lowest sulfur and coal requirements ever established in this country. In the other it required the installation of two separate scrubbers at two separate plants.

New York is now reviewing its entire sulfur emissions policy, and over the next several months will develop an environmental impact statement on sulfur emissions in New York. We will have completed that, I am sure, by the spring of 1984.

The purpose of this is to include the long-range transport of acid-causing pollutants. To our knowledge, it will be the first time a State has applied these criteria in a regulation of its air pollutants.

On Monday, this Monday, December 5, I think, I will meet with the Coalition of Northeast Governors to review the sulfur emission policies of our respective States and to define a regional approach to acid rain. In Rhode Island, Pennsylvania, Massachusetts, Vermont, and New Jersey. Yet, despite all we do as a State or as a region, the winds that sweep from west to east from the interior to the coast, will continue to bring their pollution to threaten our natural resources, to destroy our woodlands and foul our lakes and rivers.

The Federal Government alone has both the authority and the resources to end this threat. For several years now our own Senator, Pat Moynihan, has, as you know, worked tirelessly and effectively in the Senate to draw attention to the present danger of acid rain and to insure a Federal role in achieving a solution. As a pioneer on this issue, Senator Moynihan has succeeded in having the Committee on Environment and Public Works adopt the first Federal legislation to deal with acid rain. We are indebted to him on this matter as we are on so many others. We are deeply grateful for his leadership. And we are also thankful, Mr. Chairman, for your work in the House, specifically for the legislation that has been introduced, and I want to pay again a compliment to Congressman Sikorski.

I support the legislation, H.R. 3400. I believe it gives appropriate recognition to the scope and magnitude of the issues. The first legislation to recommend siqnificant reductions in so-called precursor gases, sulfur dioxide, and nitrogen oxide. It establishes a reasonable schedule for achieving reductions in emissions. Perhaps most important, it incorporates an idea that I believe was first espoused by our distinguished former Senator, Jack Javits, the idea that funding should be provided to lessen the rate shock on utility ratepayers.

Adoption of this legislation will, in our opinion, involve significant economic costs, and that is unavoidable. But we have, it seems to us, an obligation to minimize the human cost of this program as well.

I fully support then the emphasis of H.R. 3400 on the use of technological controls for attaining a large percentage of the total emission reduction goal. The economic cost of requiring technological controls may be higher than for some other strategies, but these controls avoid the widescale unemployment that might occur in coal regions if strategies such as fuel switching became the norm.

So overall in New York, we are pleased with H.R. 3400. There are, however, some specific areas where we believe it could be improved. For example, H.R. 3400 does not address the need to provide rate relief for low-income households. Estimates of the cost involved in putting in place the technology needed to control damaging emissions, indicate that utility rates in some States might increase from 6 percent and above. Because of this we suggest some exemption for low-income households along the lines of what was recently recommended by the New England congressional caucus.

H.R. 3400 presently requires that sulfur dioxide emissions be reduced by 10 million tons, the minimum acceptable level of any national emissions reductions program. It is our recommendation that this be increased to achieve a 12-million-ton reduction by 1995, thus reaching the goal that has been called for by the National Academy of Sciences. H.R. 3400 imposes a 1 mil per kilowatt-hour tax on nonnuclear electricity generation, which would be used to subsidize the cost of emission reducing technology.

Now New Yorkers are willing to contribute to these costs if such a provision is needed to insure enactment by the Congress, but from our viewpoint there is, of course, a preferable alternative that we hope is not totally beyond the realm of possibility. We favor the imposition of a tax on emissions of sulfur dioxide and nitrogen oxides. We think that is a fairer approach of spreading the cost of control. Again, understanding the practicalities and realities, which you are in the best position to make that judgment as to what can be achieved.

New Yorkers have already made significant reductions in acid-causing emissions. During the period from 1968 to 1980, we reduced total annual sulfur dioxide emissions from 1.8 billion to half of that, 900 million tons. Utility annual sulfur dioxide emissions from 840,000 to 480,000 tons. These reductions were not achieved without cost to this State, largely due to the higher cost of low-sulfur fuels, New Yorkers pay utility bills among the highest in the country. I would guess that the southeastern part of New York State pays higher utility costs than any place in the United States, and that is in part because of our attempts at self-help here, of which we are very proud.

As H.R. 3400 is presently written, it appears that the $100 million annual contribution by New Yorkers to the acid deposition control fund would be spent entirely on other States, with no part of it used to meet the cost of further emissions reductions in New York.

An emission tax would be more equitable. Certainly there are clear national precedents for requiring the pollutor to pay. The great achievements made under the Federal Water Pollution Control Act were possible because the act places the financial burden on the waste generator. An emissions tax is a demonstrably workable incentive for industries and utilities to reduce their emissions. Yet while New York State believes an emissions tax is a more preferable and equitable approach, again, we defer to your superior knowledge and understanding of the process and the practicalities, our overriding objective is congressional enactment of a national acid rain reduction program.

We are ready to work with you, Mr. Chairman. We are ready to work with the entire committee. We are ready to work with all other congressional leaders on alternative funding proposals, perhaps some combination of an emissions tax and a generating tax.

At the upcoming meeting with my fellow Northeast Governors, on Monday, we will discuss these alternatives. Under the bipartisan leadership of my colleagues, Governor Tom Kean of New Jersey and Governor Mike Dukakis of Massachusetts who have already expended substantial time and resources on this effort. And I am confident that we will soon reach agreement on a proposal to provide an adequate and equitable funding source that will allow us to proceed toward adoption of our common objective and I am confident we are going to be able to do that unanimously as a group of Northeastern Governors.

The exact details of an effective and workable national acid rain program remain open to debate and perhaps improvement. And we will work with you to achieve a bill that is fair to all parties, one that protects the environment without unjustly apportioning the cost of that protection.

Mr. Chairman, what it seems to us is now totally beyond debate, is the sheer urgency of this question, the obvious necessity of taking action before the effects of acid rain become irreversible and precious preserves of water and woods are condemned to ecological death. The Office of Science and Technology policies, the national precipitation assessment program, and the National Academy of Sciences have all called for immediate action to reduce the emissions that cause acid rain.

Science and logic and experience all tell us that the time to act is now; indeed it is past. That by delaying further we risk our future and the future that we leave to our children. I believe we are too great a nation and too good a people to deny this problem any longer, to let vast areas of our Nation be destroyed, to let acid rain continue to fall on our towns and our forests and our lakes. I believe we are wise enough and intelligent enough to act before it is too late. Thank you.

Mr. WAXMAN. Thank you very much, Governor Cuomo. Let me commend you. Obviously there are others here who feel, as I do, that you gave an excellent statement. I want to commend you on that, and also to applaud the efforts that have been taken here in New York and the leadership you have given with other Governors in this region to do what you can about the problem of acid rain.

But the fact remains, as you so clearly pointed out, that we need Federal legislation, because no State line has been a barrier for acid precipitation crossing from one State or one region to another.

And I also agree with you wholeheartedly that there is a sense of urgency in our need to deal with this problem. Much of the damage is irreversible, and that which can be reversed is going to be far more costly if we delay in setting something in motion to control the causes of acid rain. I want to thank you very much for your statement.

Mr. Scheuer, I want to recognize you for any comments or questions you may have.

Mr. SCHEUER. Governor, that was a marvelous statement. It was not only fact filled, but it was an inspirational statement, the kind we have come to expect from you. We appreciate it.

You did mention that we have cut acid precipitation by about half in the last decade. Now, has that demonstrably improved the situation in New York State?

Governor CUOMO. Yes, improvement can be demonstrated, but I would not for a minute suggest that we have a right to be pleased at where we are now. We need to continue to work hard and that is why we are putting together our impact statement this spring. There is a lot more we have to do.

Let me say quickly, we live in a world of more than one truth, and more than one truth that operates simultaneously. We believe this is a Federal problem. We believe that the Federal Government has failed in its responsibility. We also believe at the same time we have an obligation as a State to help ourselves as much as possible. We are proud of what we have done, but we have to do more. And we hope to set an example in this State for the whole country, that says that while we ask for help from the Federal Government, we earn it by being very aggressive in our own sacrifice to help ourselves, and that is what we are doing. So we have done well. We have more to do.

Mr. SCHEUER. To the extent that we can prove that the 50-percent reduction in the production of acid rain here has given us a comparable reduction in polluting effects does not mean that the stuff just bleeds over borders and it is not only a regional problem, it is a national problem, and sort of like gun control, unless you stop it everywhere, you cannot stop it anywhere.

Governor CUOMO. I think that is right. It is a good point to make. We have tried to make it. It is a good point to reiterate. I thought that it was almost obvious to the people of this country. It should be to those that are paying attention that we cannot control it within the borders of New York State. We do what we can. We are victimized by God's winds which carry material from the Midwest to the Northeast, and there is nothing we can do about that. That can only be dealt with nationally. There is also an international element to it, because to the north we have Canada, and their own industrial base, and I will be traveling to Canada frankly on December 16 with the Prime Minister of Quebec, to discuss acid rain and hydropower.

Mr. SCHEUER. Has the National Governors Association taken a position on acid rain?

Governor CUOMO. Well, the NGA, I do not think we have as a national group. Because, the same problem you have in Congress, we have as Governors. The Governors of California and the West have one set of concerns. The Governors of the Midwest have another. And we have competing considerations. The Northeastern Governors have a commonality of interest or at least closer to a commonality, and we will be meeting on Monday to create a regional position. I hope and suspect that that will be a unanimous position. My guess, and it is only a guess, is that it will be a compromise position of some kind that will be somewhere between generation paying for it and emissions paying for it and will be a kind of 50-50 proposition or something like that. But that is only a guess.

Let me underscore this. What we are going at it regionally, in the best of all worlds, we would see the country as a family, just as we try to think of the State as a family. This is a problem that ought to concern at least the 48 States that are on the continent from the Pacific to Atlantic. This is a problem whose dimensions are so enormous, it ought not to be thought of as regional, anymore than the problems of the South after the Civil War would have been regarded as regional. It was the Northeast and the strength of the Northeast that saved the rest of the country, because we saw this Nation as a family.

And while politically we marshal all the regional strength we can for obvious reasons, we do not want that to be taken as a signal that we regard it as only a regional problem. It is not.

Mr. SCHEUER. Well, I thank you for the terrific leadership you are giving on behalf of our State to this great national problem.

Mr. WAXMAN. Mr. Sikorski.

Mr. SIKORSKI. Thank you, Mr. Chairman. Governor, I applaud your efforts and thank you for the support of H.R. 3400. That is important support because New York's experience parallels that of Minnesota. We, since 1972, reduced our emissions, SO_2 emissions by two-thirds. We have enacted the first acid rain control law in the Western Hemisphere. We entered into an agreement with Ontario just this past spring.

But I think we reluctantly concluded, as you have, that we have so much at risk from an environmental and economic standpoint, that we are willing to say that it is a Federal problem from the standpoint we need to enact a Federal law to get to the source, the major sources. But we also have to look at it as a national problem from the standpoint of paying for it, because we have a lot at risk, and I think your statement to that effect is very helpful.

I have been doing a lot of looking at the emissions tax approach and it is very attractive, theoretically. I hope people focus on administrative costs as well as the time problems and the whole fuzziness of putting something like that into effect when we are actually reaching out for a year, 6 months, could mean the difference of several lakes in New York, it could mean the difference of several lakes in Minnesota and across the country.

We have talked about the Northeast and the Midwest as being at risk, but we know from the EPA's own maps, that the large areas of the South and Southeast and California and up the west coast and the Northwest is at risk as well. And of the 48 contiguous States, 46 of them have major land soils areas that are at risk as well. So the issue goes beyond our regions. And I would like to just thank you for your efforts and leadership and I hope you get the New England Governors to come along with you. Thank you.

Mr. WAXMAN. Mr. Ottinger.

Mr. OTTINGER. I, too, want to congratulate you on a really fine statement. I think we should take into account your advice certainly with respect giving some kind of relief to low-income ratepayers. I know in my own area the cost of electricity is the chief economic deterrent both to low-income people and business. And what you say about our paying the highest costs in the country, indeed in the world is true.

I would suggest that in your deliberations with the region, you might look at other alternatives, other than an emissions tax. There is a recent Office of Technology Assessment report which indicates, and Congressman Sikorski was alluding to it, that the cost of administering and measuring the emissions tax would be unduly onerous. And as I said, there is a really practical problem because an emissions tax would result in a heavier penalty being borne by the most economically distressed areas in the country at the present time.

I think they might more profitably take into account directly the expenditures that have been made in New York by TVA and other groups to already alleviate this by having some kind of credit built into the legislation for efforts that have already been made. And I think that might be a more measurable, and more easily administered form of relief than changing the whole rate structure.

I would hope that when you meet with the regional Governors, you might take that into consideration.

Governor CUOMO. I think, Congressman Ottinger, the matter of discrete specific remedies is a very difficult one, but it is enormously consoling to see how much in agreement we all are on the general principles, and that is that it is national. That you do need an equitable solution. That you do need to share the burden. That you ought to take into account the enormous amount that has already been done and the enormous sacrifice that has already been undertaken in its own behalf by States like Minnesota and New York.

So we appear to agree on all the parameters and however difficult the mechanical matter of getting down to discrete solutions, I think that is not an insoluble problem and working together, I am sure we will be able to do it.

Mr. Ottinger. Well, I would like to express our eagerness, not only our willingness, to work with you and to try and work out a solution that is nationally acceptable and will take into account some of our own special problems. I particularly would be remiss if I did not thank you for supporting my efforts by saying in your testimony that we make this a full 12-million-ton reduction program and meet the requirements that were laid down, as you pointed out, by the National Academy of Science.

Mr. Waxman. Thank you, Mr. Ottinger. Governor Cuomo, let me thank you again for being with us. We appreciate your testimony. We are going to look forward to working with you on this legislation.

Governor Cuomo. Thank you.

Mr. Waxman. We are pleased now to call forward representatives of the U.S. Congress who are taking a leadership role in trying to deal with the acid rain situation. And the one who I think deserves the highest praise for his efforts in the U.S. Senate is your own Senator here in New York, Daniel Patrick Moynihan.

Senator Moynihan was the author of legislation that is now on the books. It has been the basis for anything we will be able to do in controlling acid rain deposition.

Senator Moynihan, we appreciate the fact you were able to clear your schedule so that you could join us at this hearing. Testifying with you are three of our colleagues, Congressmen Sherwood Boehlert, David O'B. Martin, and Guy Molinari, all from the New York State area, who have authored legislation in the House of Representatives and are taking a very active role.

This panel and representatives of New York's government show us very clearly that this is a bipartisan issue. It is not one where one party or the other should be allowed to use it as a campaign matter. It should be one where we get together, address problem, and get going on solving that problem.

Senator Moynihan, we are pleased to have you with us. I would like to call upon you at this time for your statement.

STATEMENT OF DANIEL PATRICK MOYNIHAN, A U.S. SENATOR FROM THE STATE OF NEW YORK

Senator Moynihan. Thank you, Mr. Chairman, Mr. Sikorski, welcome to New York. I welcome your friends and colleagues. It was very generous of the chairman to make the point that as of this moment the only statute we have in this area is the Acid Precipitation Act of 1980, which I introduced in 1979.

This was no inspiration of mine. It rose out of concerns that are very much encountered in New York and in Canada. It was really the Canadians that first brought this matter to us. and we ought to acknowledge that and we ought to acknowledge that we still have not responded to their concerns.

I think New York scientists can take very considerable pride in what they have done. Representative Ottinger stated that we are beginning to understand the process by which an increase in the acidity of precipitation releases chemicals, metals in the soil. Much work was done at Cornell; the cycle by which fish die in granite-based lakes was worked out by a Cornell biologist. This is the first sort of insight into what was going on.

I have a statement here Mr. Chairman, which, with your permission, I would like to put it in the record. I have three colleagues with me, and I think that rather than read my statement, I would just like to summarize it.

Mr. WAXMAN. Without objection, your statement in full will be made part of the record.

Senator MOYNIHAN. The object of our 1980 legislation was, in my mind at least, a fairly simple one. It seemed to me the history of these subjects was that you could never create an effective public constituency to do something about acid rain until first we had learned to measure it and, second, to substantially explain it. This is a task well within the range of normal science. It will always have its normal periphery of disagreement. That will be always there. But that is called normal science.

Since then we have been receiving in results a lot faster, frankly, than I expected. There was more work to be done than I certainly knew about. The Interagency Task Force on Acid Precipitation, which was one of the aspects of our 1980 legislation, came forth just a short while ago saying that manmade atmospheric pollutants are probably the major contributors to acid rain deposition in northeastern America. I note the word probably. You are asking scientists their best judgment. All science is statistical and all science is based on probabilities. And these probabilities are beginning to be settled.

The United States-Canada scientific studies on acid rain have made very clear the notion that SO_2 emissions need to be reduced if we are going to have a reduction in acid sensitivity in lakes.

Maybe the most important work being done just now is by the National Research Council, which has just ended its study Acid Deposition: Atmospheric Processes in Eastern North America, and its conclusion. (This is very much a science.) A conclusion, if you will allow me: It says, "there is no evidence for strong nonlinearity in the relationships between long-term average emissions and deposition." That sounds more like a remark we make in the Senate and you make in the House where you have to be direct. You only have a minute usually.

But the statement that there is no evidence for strong nonlinearity is important. What it means is that to the best of their knowledge, what goes up, comes down. And if that seems obvious to you it is because you are not a meteorologist. It is not obvious. It is a case that has to be proved and they are on the edge of thinking they have proved it.

If we know that, then we know enough to act.

The White House Acid Rain Peer Review Panel recently said that the nature of the acid deposition problem demands that actions have to be taken despite incomplete knowledge. And I think we all ought to be serious about this and know we act on incomplete knowledge. People whom we respect say there is no evidence for strong nonlinearity, and that is about as much as you are likely to get before a very long while.

Given what we know, what can we do? I know, sir, that you have a problem in the House, Mr. Chairman. Mr. Sikorski has explained it very clearly, but I would like everyone here to know that in the Senate Committee on Environment and Public Works, we took up this issue as part of the reauthorization of the Clean Air Act and we had it before us during much of the 97th Congress. I had introduced a bill calling for a reduction of 8.2 million tons in sulfur dioxide emissions. Senator Mitchell asked for 10 million tons, and 12 million tons is the reduction sought by Mr. Ottinger.

But such as it was, on July 22, 1982, by a vote of 15 to 1 the Senate Environment and Public Works Committee voted to cut emissions by 8 million tons, and to do so at the site.

Now we are a pretty collegial committee, this particular one, but 15 to 1 is a pretty strong vote anywhere. It is evident from that vote that that one should not assume that no consensus can be reached with respect to reducing the actual pollutants.

I would like to say, too, I cannot endorse a scheme that taxes electricity in New York to pay for the installation of pollution control equipment in the Middle West. The purpose of this kind of tax is to get less of something and what we want is less pollution, not less electricity.

It seems to me that there were decisions made in the Middle West to continue using coal—coal with a high sulfur content. They were political decisions.

And I do not know why we cannot consider getting the votes for our bill.

I think I have to say, Mr. Chairman, the Governor pointed it out, that here in New York City we have the highest urban electricity costs in the Nation, 13.3 cents per kilowatt-hour. If you would like to see the results, look about you. I was raised just 50 blocks north of here on the west side and that is not what the skies used to look like in December, or anything like it. They do now. We pay for this. A lot of places have not, but we are paying for a lot of things we have done. Let me just close by saying that if we continue to add to our cost of electricity, we continue to add to this disparity between the comparative economic costs of doing business in New York and the rest of the country. We have just a little bit of defense industry left in this country, in Mr. Mrazek's district and all around Long Island.

Mr. SCHEUER. In this State, you mean?

Senator MOYNIHAN. Yes, in this State, I am sorry. Grumman and Fairchild have electricity rates which are pressing right down to their degrees of profitability and now we have another problem out there, which is of our own making, which may make it worse.

To give you an example: in fiscal year 1982, the Department of Defense spent $491 for every resident in New York and $1,256 for every resident of California, a ratio of 3 to 1.

I would not in any way want to act like this should be the determinant of our final decisions on acid rain, but I would just like to make a point to you. The Congressional Research Service has put out an estimate of population by the year 2000, for our State, your State, and the others. It is estimated by the year 2000, California will have twice the population of New York, and will have 50 Members of the House of Representatives which New York will have 24. Having 41 not long ago, we will have 24.

Now the climate is not bringing this result. It is nothing more than the inexorable movement of economic activity out of this region owing to various costs. And anything that adds to our costs especially for things we have not done and penalizes us for things we have done, it seems to me, is not equitable and not wise. But I think somewhere between what the House is proposing and what the Senate committee has adopted, there is a resolution. And we are going to have to do this. We are going to have to do this without the President. We know that.

[Senator Moynihan's prepared statement follows:]

STATEMENT OF SENATOR DANIEL PATRICK MOYNIHAN (D.,N.Y.)

BEFORE

SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT

Mr. Chairman,

Let me welcome you to New York. I can think of no more appropriate place for today's hearing. New Yorkers have long been concerned about acid rain, a phenonmenon that is doing serious harm to our State's environment and that of other sensitive areas in Eastern North America.

It was this concern that, on September 14, 1979, led me to introduce S. 1754 which became the Acid Precipitation Act of 1980 (P.L. 96-294). This was and remains, the only, I repeat only, federal statute on this matter.

I was concerned in 1979 because I knew that something was seriously wrong. Many of our Adirondack lakes and ponds were dying, poisioned by acidic deposition. Having served on the President's Science Advisory Committee and on the Board of Directors of the American Association for the Advancement of Science, history, if you like, taught me that we could never create an effective public constituency to do something about acid rain until, first, we learned to measure it, and second, substanti~~vely~~ally to explain it. That task is well within the range of normal science. The Acid Precipitation Act of 1980 set the Federal government to that task.

The results are coming in fast and furious, and some of us are getting furious about them. The 1982 Annual Report of the Interagency Task Force on Acid Precipitation said, and I quote, that,

> Man-made atmospheric pollutants are probably the major contributors to acid rain deposition in northeastern North America.

On June 23, 1983, the President's Acid Rain Peer Review panel, a group appointed by the President's Science Advisor to review U.S.-Canada scientific studies on acid rain, issued its initial report. The panel concluded:

> Reductions below present SO_2 emission levels would reduce total sulfur deposition levels and as a consequence both reduce the probability for major changes in additional acid sensitive lakes or forests and allow the possibility for a return to original biological conditions existing in recently acidified areas.

Also in June, the National Research Council of the National Academy of Sciences issued a report entitled "Acid Deposition: Atmospheric Processes in Eastern North America." This report contains significant findings about the relationships between emissions and deposition. The study concludes, "... there is no evidence for a strong nonlinearity in the relationships between long-term average emissions and deposition." The study goes on to say:

> If we assume all other factors, including meteorology, remain unchanged, the annual average concentration of sulfate in precipitation at a given site should be reduced in proportion to a reduction in SO_2 and sulfate transported to that site from a source or region of sources.

In testimony on November 2, 1983 before the Senate Committee on Environment and Public Works, of which I am a member, Dr. Myron Uman of the National Research Council gave an excellent and comprehensive presentation of the findings in the Council's June report. In summary, we can conclude from the Council's study that reductions in sulfur dioxide emissions in the 31 state region of the Eastern United States will yield reductions in sulfur deposition in the Eastern United States approximately in a one to one proportion.

Each of these three recent reports affirms, I believe, the actions taken earlier by the Senate Environment and Public Works Committee. Let me make special note here of one finding contained in the Acid Rain Peer Review Panel's report. "It is the nature of the acid deposition problem that actions have to be taken despite incomplete knowledge," the group concluded. I endorse this proposition. While we do not know all there is to know, we do know enough to take action to control acid rain before irreversible damage is done to our nation's environment.

On the basis of accumulated information, the Senate Committee on Environment and Public Works did act. On October 6, 1981 I introduced a bill (S. 1709) calling for an 8.2 million ton reduction in annual sulfur dioxide emissions over a ten year period in the Eastern United States. The Committee held hearings on this and other proposals, and on July 22, 1982 adopted an amendment calling for an 8 million ton reduction in sulfur dioxide emissions over a twelve year period in the Eastern United States. This amendment was included in the Committee's bill to reauthorize and strengthen the Clean Air Act, a bill that was reported out of committee in August, 1982 but failed to reach the Senate floor before adjournment of the 97th Congress.

The Acid Rain amendment adopted by the Senate Environment and Public Works Committee recognizes that the sources of the man-made emissions causing acid rain should be the ones to reduce their emissions. There are thirty-one states in the Eastern United States, producing a total of 22 million tons of sulfur dioxide annually. Half this total comes from six states: Ohio, Pennsylvania, Indiana, Illinois, Missouri, and Kentucky. The Committee amendment requires that the largest reductions take place in the states with the greatest emissions. This seems to me wholly consistent with the findings of the National Research Council's June report.

Mr. Chairman, as one long involved in the work of securing federal acid rain legislation, I commend your efforts to gain passage of an acid rain control bill in the House of Representatives. In the last Congress, the House Committee on Energy and Commerce declined to approve a major sulfur dioxide emission reduction program, similar to the one passed by te Senate Committee on Environment and Public Works. The introduction of your bill, H.R. 3400, in this Congress certainly has advanced serious discussion and debate on this matter in the House.

However, I must take exception to at least one provision in your bill.

I cannot endorse a scheme that taxes electricity in New York to pay for the installation of pollution control equipment in the Midwest. A tax that falls only on the generation of electricity is inefficient and most inequitable.

Here in Manhattan, where Consolidated Edison supplies electricity, residential customers pay an average of 13.3 cents per kilowatt/hour. The national average cost of electricity for residential customers per kilowatt/hour is 6.7 cents. In Indiana the cost is 5.7 cents, in Illinois it is 6.1 cents, in Ohio it is 6.7 cents, and in California it is 7.2 cents. New York City pays the highest electric rate in the nation, excluding Hawaii, in large measure because of the stricter emissions standards being met by New York utilities. (For example, New York ranks 24th among the 31 Eastern states in the amount of sulfur dioxide its utilities emit per capita.)

Nonetheless, under the provisions of H.R. 3400 we would pay the same one mill (one-tenth cent) per kilowatt/hour tax on non-nuclear electricity. This is not equitable. Why should the tax be on electricity? Any economist will tell you that you tax something if you want less of it. We want less sulfur dioxide, not less electricity.

My point is that we have already paid in New York. And more than our share. Permit me to elaborate.

On July 23rd of this year, I issued a report, the seventh in an annual series, on New York State and the Federal Fisc. That is, I measured the flow of tax receipts from the people and businesses in New York to the Federal government, as against the return of Federal funds to New York State. I have issued these reports every year since I joined the United States Senate in 1977, out of one of the chief concerns which motivated me to represent the people of New York in the U.S. Senate: the perception, which our data established as accurate, that New York State is consistently short-changed in its fiscal relationship with the Federal government. Our study was the first of its kind, and remains the only report of this kind, either for New York or any other state.

As an example, on a per capita basis the residents of California received $509 more in federal spending in FY 1982 than the national average. That's $610 more per person than did the people of New York, or $2500 more per family.

Much of this disparity reflects the distribution of defense spending, which represents the government's largest discretionary fiscal decision. The Federal government cannot choose where Social Security funds will go: they go wherever eligible retired Americans live. Similarly, within certain constraints, the funding for welfare programs goes where impoverished families are located. But state-by-state demographics do not determine the distribution of certain other kinds of federal spending, and defense is the number-one example.

Consider this. In FY 1982, the Defense Department spent only $491 per New Yorker in our state -- one-third less than the national average. In California, Mr. Chairman, defense spending in your state amounted to $1256 for every resident -- two and one-half times the rate for New York residents.

This disparity, moreover, reflects another finding from my seven annual studies of New York and the Federal Fisc. Much of the defense spending in California goes to "hard" expenditures -- military procurement which requires capital investment and directly creates jobs. In contrast, federal spending in New York has been concentrated in "soft" expenditures, primarily transfer payments, that stimulate consumption but not investment or jobs.

Indeed, the only two major aerospace manufacturers in New York, Grumman and Fairchild Industries, are located on Long Island where electricity rates already are the fourth-highest in the Nation. Another additional tax on electricity could well cost New York these employers, with devastating effects on Long Island.

There's more. Apart from the tiny state of Rhode Island, New York was the only state in the country to lose population in the 1970s. Now, George Masnick and John Pitkin of the Joint Center for Urban Studies at MIT and Harvard University have reported that, based on census projections, New York will lose about 3 million more citizens by the year 2000. California, Mr. Chairman, can expect to gain about 6 million more citizens, so that by the year 2000 California is projected to have twice the population of New York.

The American people go where their economic opportunities lie. Economic opportunities abound, in part, where Federal funds flow -- as federal funds will tend to flow where population and economic opportunities are available. It is a vicious cycle in which New York finds itself.

In 1960, New York State claimed 41 members of the nation's House of Representatives. By 1970, declining population reduced our State's delegation to 39 members. After the 1980 census, the State's representation fell to 34 members. It may well get worse. According to a study by the Congressional Research Service, based on 1983 census projections the New York Congressional Delegation will fall from its present 34 members to 29 in 1990, and again to 24 members by the year 2000. California, Mr. Chairman, is projected to increase its delegation from its current 45 members to 48 in 1990, and to 50 representatives by the year 2000.

Mr. Chairman, I have the greatest respect for you and your exemplary work in the United States Congress. I applaud and respect your concern about and diligence on acid rain. On this, as on so many other matters, we truly are colleagues. But other matters are at stake here. The citizens of New York are reeling from overtaxation -- especially in light of the returns they receive from federal spending. I respectfully submit that the proposal to tax electricity could well worsen the fundamental problem facing the Empire state.

Mr. Chairman, while we may disagree over how to pay for an acid rain control program, we certainly do not disagree about the need to enact such a program and to do so soon. In our common efforts to achieve this objective, however, we face a common obstacle: the President. We have our work cut out for us, in both the House and Senate, if we are to pass acid rain legislation over the objections of the President. But it can and must be done, and we can do it together.

ENERGY SECURITY ACT
OF 1980

94 STAT. 770 PUBLIC LAW 96-294—JUNE 30, 1980

Acid Precipitation Act of 1980.

TITLE VII—ACID PRECIPITATION PROGRAM AND CARBON DIOXIDE STUDY

SUBTITLE A—ACID PRECIPITATION

SHORT TITLE

42 USC 8901 note.

SEC. 701. This title may be cited as the [redacted] of [redacted].

STATEMENT OF FINDINGS AND PURPOSE

42 USC 8901.

SEC. 702. (a) The Congress finds and declares that acid precipitation resulting from other than natural sources—

(1) could contribute to the increasing pollution of natural and man-made water systems;

(2) could adversely affect agricultural and forest crops;

(3) could adversely affect fish and wildlife and natural ecosystems generally;

(4) could contribute to corrosion of metals, wood, paint, and masonry used in construction and ornamentation of buildings and public monuments;

(5) could adversely affect public health and welfare; and

(6) could affect areas distant from sources and thus involve issues of national and international policy.

(b) The Congress declares that it is the purpose of this subtitle—

(1) to identify the causes and sources of acid precipitation;

(2) to evaluate the environmental, social, and economic effects of acid precipitation; and

(3) based on the results of the research program established by this subtitle and to the extent consistent with existing law, to take action to the extent necessary and practicable (A) to limit or eliminate the identified emissions which are sources of acid precipitation, and (B) to remedy or otherwise ameliorate the harmful effects which may result from acid precipitation.

(c) For purposes of this subtitle the term "acid precipitation" means the wet or dry deposition from the atmosphere of acid chemical compounds.

"Acid precipitation."

INTERAGENCY TASK FORCE; COMPREHENSIVE PROGRAM

Acid Precipitation Task Force. 42 USC 8902.

SEC. 703. (a) There is hereby established a comprehensive ten-year program to carry out the provisions of this subtitle; and to implement this program there shall be formed an Acid Precipitation Task Force (hereafter in this subtitle referred to as the "Task Force"), of which the Secretary of Agriculture, the Administrator of the Environmental Protection Agency, and the Administrator of the National Oceanic and Atmospheric Administration shall be joint chairmen. The remaining membership of the Task Force shall consist of—

(1) one representative each from the Department of the Interior, the Department of Health and Human Services, the Department of Commerce, the Department of Energy, the Department of State, the National Aeronautics and Space Administration, the Council on Environmental Quality, the National Science Foundation, and the Tennessee Valley Authority;

(2) the director of the Argonne National Laboratory, the director of the Brookhaven National Laboratory, the director of the Oak Ridge National Laboratory, and the director of the Pacific Northwest National Laboratory; and

(3) four additional members to be appointed by the President.

Research management consortium.

(b) The four National Laboratories (referred to in subsection (a)(2)) shall constitute a research management consortium having the responsibilities described in section 704(b)(13) as well as the general responsibilities required by their representation on the Task Force. In carrying out these responsibilities the consortium shall report to, and act pursuant to direction from, the joint chairmen of the Task Force.

Director.

(c) The Administrator of the National Oceanic and Atmospheric Administration shall serve as the director of the research program established by this subtitle.

COMPREHENSIVE RESEARCH PLAN

42 USC 8903.

Sec. 704. (a) The Task Force shall prepare a comprehensive research plan for the ten-year program (hereafter in this subtitle referred to as the "comprehensive plan"), setting forth a coordinated program (1) to identify the causes and effects of acid precipitation and (2) to identify actions to limit or ameliorate the harmful effects of acid precipitation.

(b) The comprehensive plan shall include programs for—

(1) identifying the sources of atmospheric emissions contributing to acid precipitation;

(2) establishing and operating a nationwide long-term monitoring network to detect and measure levels of acid precipitation;

(3) research in atmospheric physics and chemistry to facilitate understanding of the processes by which atmospheric emissions are transformed into acid precipitation;

(4) development and application of atmospheric transport models to enable prediction of long-range transport of substances causing acid precipitation;

(5) defining geographic areas of impact through deposition monitoring, identification of sensitive areas, and identification of areas at risk;

(6) broadening of impact data bases through collection of existing data on water and soil chemistry and through temporal trend analysis;

(7) development of dose-response functions with respect to soils, soil organisms, aquatic and amphibious organisms, crop plants, and forest plants;

(8) establishing and carrying out system studies with respect to plant physiology, aquatic ecosystems, soil chemistry systems, soil microbial systems, and forest ecosystems;

(9) economic assessments of (A) the environmental impacts caused by acid precipitation on crops, forests, fisheries, and recreational and aesthetic resources and structures, and (B) alternative technologies to remedy or otherwise ameliorate the harmful effects which may result from acid precipitation;

(10) documenting all current Federal activities related to research on acid precipitation and ensuring that such activities are coordinated in ways that prevent needless duplication and waste of financial and technical resources;

(11) effecting cooperation in acid precipitation research and development programs, ongoing and planned, with the affected and contributing States and with other sovereign nations having a commonality of interest;

(12) subject to subsection (f)(1), management by the Task Force of financial resources committed to Federal acid precipitation research and development;

(13) subject to subsection (f)(2), management of the technical aspects of Federal acid precipitation research and development programs, including but not limited to (A) the planning and management of research and development programs and projects, (B) the selection of contractors and grantees to carry out such programs and projects, and (C) the establishment of peer review procedures to assure the quality of research and development programs and their products; and

(14) analyzing the information available regarding acid precipitation in order to formulate and present periodic recommendations to the Congress and the appropriate agencies about actions to be taken by these bodies to alleviate acid precipitation and its effects.

Submittal to Congress, public review.

(c) The comprehensive plan –

(1) shall be submitted in draft form to the Congress, and for public review, within six months after the date of the enactment of this Act;

(2) shall be available for public comment for a period of sixty days after its submission in draft form under paragraph (1);

(3) shall be submitted in final form, incorporating such needed revisions as arise from comments received during the review period, to the President and the Congress within forty-five days after the close of the period allowed for comments on the draft comprehensive plan under paragraph (2); and

(4) shall constitute the basis on which requests for authorizations and appropriations are to be made for the nine fiscal years following the fiscal year in which the comprehensive plan is submitted in final form under paragraph (3).

(d) The Task Force shall convene as necessary, but no less than twice during each fiscal year of the ten-year period covered by the comprehensive plan.

Annual report to President and Congress.

(e) The Task Force shall submit to the President and the Congress by January 15 of each year an annual report which shall detail the progress of the research program under this subtitle and which shall contain such recommendations as are developed under subsection (b)(14).

(f)(1) Subsection (b)(12) shall not be construed as modifying, or as authorizing the Task Force or the comprehensive plan to modify, any provision of an appropriation Act (or any other provision of law relating to the use of appropriated funds) which specifies (A) the department or agency to which funds are appropriated, or (B) the obligations of such department or agency with respect to the use of such funds.

(2) Subsection (b)(13) shall not be construed as modifying, or as authorizing the Task Force or the comprehensive plan to modify, any provision of law (relating to or involving a department or agency) which specifies (A) procurement practices for the selection, award, or management of contracts or grants by such department or agency, or (B) program activities, limitations, obligations, or responsibilities of such department or agency.

IMPLEMENTATION OF COMPREHENSIVE PLAN

42 USC 8904.

SEC. 705. (a) The comprehensive plan shall be carried out during the nine fiscal years following the fiscal year in which the comprehensive plan is submitted in its final form under section 704(c)(3); and—

(1) shall be carried out in accord with, and meet the program objectives specified in, paragraphs (1) through (11) of section 704(b);

(2) shall be managed in accord with paragraphs (12) through (14) of such section; and

(3) shall be funded by annual appropriations, subject to annual authorizations which shall be made for each fiscal year of the program (as provided in section 706) after the submission of the Task Force progress report which under section 704(e) is required to be submitted by January 15 of the calendar year in which such fiscal year begins.

(b) Nothing in this subtitle shall be deemed to grant any new regulatory authority or to limit, expand, or otherwise modify any regulatory authority under existing law, or to establish new criteria, standards, or requirements for regulation under existing law.

AUTHORIZATION OF APPROPRIATIONS

42 USC 8905.

SEC. 706. (a) For the purpose of establishing the Task Force and developing the comprehensive plan under section 704 there is authorized to be appropriated to the National Oceanic and Atmospheric Administration for fiscal year 1981 the sum of $5,000,000, to remain available until expended.

(b) Authorizations of appropriations for the nine fiscal years following the fiscal year in which the comprehensive plan is submitted in final form under section 704(c)(3), for purposes of carrying out the comprehensive ten-year program established by section 703(a) and implementing the comprehensive plan under sections 704 and 705, shall be provided on an annual basis in authorization Acts hereafter enacted; but the total sum of dollars authorized for such purposes for such nine fiscal years shall not exceed $45,000,000 except as may be specifically provided by reference to this paragraph in the authorization Acts involved.

Mr. WAXMAN. Senator, I know you have to leave, so I want to address a few questions to you before calling on our House colleagues, who I realize are also on tight schedules.

We appreciate the leadership you have taken in the Senate and the strong voice you have given in support of acid rain control, and I know you share our conclusion that something must be done now and because acid rain is not a problem that is going to get better, through neglect.

The practical problems we have are very, very real. In fact, I was interested in your comments on defense spending. Some of my constituents in California get angry at me for voting against some of that defense spending. But I think we must have a national perspective on defense as well as other issues.

Some of my California constituents ask, why should they pay what may amount to a dollar more in their utility rates to deal with acid rain, which they see as a problem in the Northeast. Let the Northeast people deal with it. Let them fight with the Midwest. And what I had to say to them is that this is not just a problem of the Northeast versus the Midwest. It is a national problem. When we lose billions of dollars in our Nation's economy because of acid rain, and our natural resources are lost forever because of this pollution, then it is not just a regional problem, but one that is national.

And as we look at it from a national perspective, we have to try to figure out where we can get a solution to what is a real problem, not just to control acid rain, but the economic dislocations. Should we go forward with one solution as opposed to another?

I raise that to challenge some of the points that you have made, but not to disagree with you. Because where we have a choice, it is always better to deal with pollution problems by saying the polluters should be the ones responsible for stopping the pollution.

But if we come to what I suspect is going to be the conclusion we are all going to reach eventually, that we cannot get a bill through the U.S. Congress to do anything about acid rain unless we say it is not a case Northeast versus Midwest and benign neglect from the West, but a national problem, let us all get together and deal with it, we will probably go through 1984 without legislation and maybe 1985 and 1986 as well.

I just wanted to point that concern of mine. Whatever legislation we can get through will be one that I know you are going to be taking a very active leadership role on, and we are going to have to work out these details. The real essential point that we should agree on is that we have got to do something, and figure out how to do it, and get it passed not just by the committee, but the Senate, the House, and even a president who many of us do not agree with a lot of the time.

Senator MOYNIHAN. He signed the milk bill. He might sign this bill.

Mr. Chairman, can I just agree with you and thank you for the way you put it. We ought not lose sight of what is the optimal response. Any economist will tell you if you let people use high sulfur coal and sell it at X cost, when in fact the actual cost is X plus Y, Y being what economists call an externality, you are not paying the true costs. There are people who own this high sulfur coal, you know, and they are making a tremendous profit selling it. There are statutes that make it possible for them to sell it.

Mr. WAXMAN. The only problem is that be the people that will suffer will be the quarter of million people who will be out of work, and they are not the ones who are making all that profit.

It is a difficult, difficult problem. We will have to try to figure out the best way we can handle it because while we would like to deal with just one problem and resolve it, we often find when we deal with one that others come along as well.

Senator MOYNIHAN. The one State with a decline in population is Rhode Island. It is the one State in the Nation that lost population in the last decade. That is a result of the economics of the State. And sir I think these Congressmen will let you know we are serious about this. This is my Congressman. He will tell you.

But remember we got a bill through the Committee on Environment and Public Works, 15 to 1.

Mr. WAXMAN. There are no Midwesterners on that committee and there are a lot of them on the floor of the Senate. If we can do it, we are going to do it, and we will do it together.

Any other questions or comments by the member of the committee? Thank you, sir.

I promised Congressman Molinari that I would call on him first, and we are pleased to have him with us. I know all of us are on a tight schedule today. I realize that you are probably way behind on yours.

STATEMENT OF HON. GUY V. MOLINARI, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. MOLINARI. I appreciate that very much. I would like to submit that statement for the record.

Mr. WAXMAN. Without objection, that statement will be made part of the record in full. Let us agree as well, without objection, all statements that have been prepared for testimony today will be made part of the record, and if our witnesses will summarize those statements, it would be helpful to us.

Mr. MOLINARI. Mr. Chairman, first, I would be remiss if like my colleagues I did not thank you all for coming here today to talk about this very important subject. What happens when we talk about acid rain is that we get ourselves into a situation where we get into the fingerpointing game. Everybody is pointing fingers at everybody else and we have seen the musical chair game played by the States. Every State is suing each other's State claiming they are the ones responsible.

Now, I can tell you this, Mr. Waxman, Mr. Sikorski, that my constituents would be most willing to pay a reasonable sum on their electric bills if they could be insured that they would be able to breathe safer and cleaner air. There is no question about that or I would not be a cosponsor of your legislation. I have heard some things here this morning that were rather surprising and shocking to me and I think they should be addressed.

The Governor made a statement about our having the highest utility bills in the country. And that is a fact. That Con Edison is rated as the number one in the country. I think LILCO is number two from Long Island. But to suggest that the reason or one of the prime reasons for that is because of the pollution control costs is far offbase. Even Con Edison never made that outrageous claim. In their ads they talk about the amount of taxes that they have to collect and that is why, but not even Con Edison, I never heard that before today. Con Edison is moving in the opposite direction.

Con Edison right now has applications pending to switch from burning low sulfur coals to high sulfur, also oil, rather, to high sulfur coal, something that we have been fighting. Something that runs contrary to what we are doing here today. And indeed the State has to bear part of that blame, because it is part of the State master plan to convert some of these plants to burning coal.

And let us put it where it is. What causes acid rain in this country? I think it is an established fact, at least in my book it is, 65 percent of it is caused by the coal-burning power plants. Look at the report that was put out, Congressman Waxman, I think you are responsible for the funding of that several years. It shows that in your high river basin area, 163,000 people who died prematurely from the coal-burning power plants of the Midwest by the turn of the century. Good God, we know that in the area represented by my colleagues on my right, the Adirondacks, the damage is obvious. The trees are dying, the plant life is dying, the fish have died. But we do not hear much talk, and I was pleased to hear Mr. Ottinger talk about the danger to human health.

The dry sulfates, what attention is being focussed on that? Let us put it in proper perspective. I am not here defending the administration in Washington. I am just as severe a critic of what has been happening or not been happening.

Congressman Scheuer, I was one of those few that were present that day, and I heard the president make the charge to Mr. Ruckelshaus that he must do something about acid rain. I think he is trying. I think his chief opponent is Mr. Stockman, who has made a statistical analysis showing that it would cost under some of this legislation between $6,000 and $10,000 per pound of fish, if we were to put these controls into place.

Never once does he talk about human health and what the costs would be.

So that I think, and when we look at it realistically, gentlemen, we have an obligation ourselves. And that is it is not enough to look at the others and say that they have done this or have not done that. We, as members of the House of Representatives, have an obligation to move forward in this very important matter.

Now, I am talking to the wrong people because those of you up there have been the leaders in the House in this very important area. Congressman Scheuer was on a plane with me with the President one day in Air Force One, and he grabbed his ear that day and tried to get him a copy of the report that dealt with this issue. So that it has been a bipartisan effort.

But I am afraid that if we get into the area where we start pitting sections of the country versus other sections of the country, we are never going to pass any legislation. We have to stand together and say we are going to bear reasonable cost and I think the Sikorski bill is a very balanced approach. I am pleased to be a cosponsor of that.

I am tired of hearing the coal industry come forward and say that the reason for the problem of acid rain is with the lakes. You have heard that, I am sure. It is the fault of the lakes. God did not create them with enough buffering capacity. That is what happened. And if they had enough buffering capacity, they would still be alive today and the fish would still be alive today. Unbelievable.

I am trying to terminate because I know we have a lot of other witnesses. But it is similar to the tobacco industry and how long they have worked to try to prove that smoking indeed might be helpful to you. And I have heard the coal industry cite studies showing that people near coal-burning regions had a lower incidence of lung cancer. What do they suggest? That if you want to reduce lung cancer, go where they are going to burn coal and you would have a better chance of surviving from that disease.

It is ridiculous. Gentlemen, I commend you for a very important effort. I feel very seriously about the issue. It is something that has bothered me deeply. I come from a community that is heavily stressed. And we have one of the highest respiratory cancer rates, Staten Island.

If it means asking our constituents to dig in their pocket for a reasonable sum, I think we are going to surprise a lot of people by seeing the willingness to do so. Thank you very much.

Mr. Waxman. Thank you, Mr. Molinari. Let me just say that after hearing your testimony and the way you put the whole issue I can understand why your constituents, Democrat and Republican alike, keep reelecting you and having you in there fighting for them. We thank you very much. You are not speaking just to us because we are with you. You are making a part of the record that we are going to share with all of our colleagues why all of us together need to do something about this problem.

I understand you have to leave. If you can stay, fine. But if you do have to leave, we certainly would understand that.

Congressman Martin, may we hear from you next?

STATEMENT OF HON. DAVID O'B MARTIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. Martin. Thank you, Mr. Chairman. I will summarize my statement. I did want to point out, as Mr. Molinari leaves, that you are indeed correct, Congressman. His people are very privileged to be represented by him. I served with him in the State Assembly and we have been through hours of debate together, I am fascinated with his ability to carry on that very good, strong argument concerning coal. He has been doing that for a long time, and we can use his help.

But we are here in the World Trade Center. My 26th Congressional District is hundreds of miles north of here. And it really would not be difficult to imagine that those beautiful lakes and streams and mountains are thousands of miles away. But it all is within this great State of New York. It would be inappropriate, it could not be more appropriate, I should say, by the same token, for us to be meeting here, because it is not just a problem of that district that I represent, which could be argued is the impact area, and prime impact area in the Adirondack Mountains for acid rain.

But it also affects us right here in the city of New York with the monuments and the bridges and the structures. And I think the work of you and your committee has helped to get that point across. And I want to join my other colleagues in welcoming you here to New York State.

If anything has been underscored by this particular hearing, it is the apolitical nature of our willingness to attack this problem. It runs across the spectrum from Guy Molinari, here in the city, to Sherry Boehlert, my neighbor to the south. It runs across political lines. It runs across Federal and State lines. Senator Pat Moynihan is here. My good friend Senator John Dunne is here. Attorney General Bob Abrams is here. And we are all working for a common goal.

I am here today to voice my support for H.R. 3400, which of course I am cosponsoring with you, for two basic reasons. One is that we must act now. And I think we are all in agreement there. But, secondly, and as importantly I think, this legislation would do it in an effective and equitable and politically achievable way. A number of pieces of fine legislation have been drafted and some people have gotten a lot of mileage on it, quite frankly, and big headlines. But I think many people knew that some of these solutions were going nowhere. And the importance of any piece of legislation is when it goes into effect.

Quite frankly, I have been criticized in the past for refusing to embrace some of those, and I steadfastly refused. Because of them, my constituents mistakenly believed that the solution would be easily or painlessly obtained. And I think whatever we would like to have for legislation, let us do something quick, and let us get something that is doable, and I think this is genuinely doable. But the point is, let us not argue the thing for another decade, but let us take a step because we have lost an awful lot of the lakes in the Adirondacks.

I wanted to speak also on something that has been touched upon, concern for our Canadian neighbors. I have many, many miles of common border with our Canadian friends. And I also have been privileged to serve on the Canada-United States Interparliamentary Group. And I know my friend, Mr. Scheuer, has from time to time been at those meetings. I wanted to point out, while the relationship, relations between the United States and Canada, are not going to completely fall apart, believe me, the question of acid rain touches every aspect of our relations with our greatest ally friend and neighbor. And everytime we go to one of those sessions, we dedicate a lot of time, believe me, a lot of time, to acid rain because across the spectrum in Canada every political party, every political situation, wants something done, and they are willing to work and clean up their own backyard as well.

I wanted to say that I would have liked to have had this hearing in Lake Placid, as the Governor said, but I also wanted as many of you people as possible to be there and it is not always the most convenient place to get to, although it is by far the most beautiful.

But I do want to point out that I was privileged to host a delegation of some seven or eight Congressmen, led by Jim Scheuer, at Lake Placid. And I want to point out to all of you folks that you may not like it quite as well in the winter. I indeed do like it year-round. But you have a standing invitation and you need only give me a moment's notice and we will make sure that you are taken to God's country to see the effects of acid rain directly.

So let us go on with it, except to point out that notwithstanding all the damage that we know that happens to the lakes and streams of the Adirondacks, it still is perhaps the most beautiful place in the world. I recommend it to you highly next you get one of your small vacations. Thank you for having me.

[Mr. Martin's prepared statement follows:]

TESTIMONY OF
REP. DAVID O'B. MARTIN (R-NY26)
BEFORE THE
HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT

DECEMBER 1, 1983

MR CHAIRMAN, MY 26TH CONGRESSIONAL DISTRICT IS LOCATED IN RURAL NORTHERN NEW YORK, HUNDREDS OF MILES FROM NEW YORK CITY. IN FACT, AS WE SIT HERE IN THE MAMMOTH WORLD TRADE CENTER, ABOVE THE BUSY STREETS OF LOWER MANHATTAN, IT IS NOT HARD TO IMAGINE THAT WE ARE THOUSANDS OF MILES FROM THE MOUNTAINS, FORESTS, LAKES, FARMS AND SMALL TOWNS OF MY DISTRICT.

AS I AM SURE YOU ARE AWARE, A GOOD ARGUMENT CAN BE MADE THAT MY DISTRICT, WHICH INCLUDES ALMOST ALL OF NEW YORK'S ADIRONDACK MOUNTAINS, IS AFFECTED BY ACID DEPOSITION TO A GREATER EXTENT THAN ANY OTHER. TO CITE JUST ONE EXAMPLE, OVER TWO HUNDRED OF OUR BEAUTIFUL LAKES NO LONGER CAN SUSTAIN FISH LIFE BECAUSE OF THE HIGH ACIDITY OF THEIR WATERS. MANY MORE ARE ENDANGERED.

AND YET, IT IS NOT AT ALL INAPPROPRIATE THAT WE SHOULD BE MEETING HERE IN NEW YORK CITY TO ADDRESS THE CRITICAL ISSUE OF ACID RAIN. IT IS A REAL AND PRONOUNCED PROBLEM THROUGHOUT THE NORTHEAST. IT THREATENS NOT ONLY THE LAKES, FORESTS AND CROPS OF DISTRICTS LIKE MINE, BUT THE BUILDINGS, MONUMENTS, BRIDGES, AND EVEN THE WATER SUPPLIES, OF OUR GREAT CITIES AS WELL.

INDEED, YOUR KEEN INTEREST IN THE ACID RAIN PROBLEM, MR. CHAIRMAN, AND THE HARD WORK OF YOUR SUBCOMMITTEE, TESTIFY THAT ACID RAIN IS NOT SIMPLY A RURAL PROBLEM OR EVEN A REGIONAL PROBLEM. IT IS A NATIONAL AND INTERNATIONAL PROBLEM AFFECTING THE INTERESTS OF EACH OF US.

IT IS MY PLEASURE TO WELCOME YOU TO OUR EMPIRE STATE AND TO THANK YOU AND YOUR SUBCOMMITTEE FOR YOUR VISIT TODAY AND YOUR EFFORTS TO ADDRESS THE ACID RAIN PROBLEM WITH EFFECTIVE, REASONABLE AND EQUITABLE LEGISLATION.

LIKEWISE, IT IS A PLEASURE TO SERVE WITH MY DISTINGUISHED FRIENDS AND COLLEAGUES ON THIS PANEL, PARTICULARLY BECAUSE IT IS SO REPRESENTATIVE OF NEW YORK STATE'S BROAD, BIPARTISAN SUPPORT FOR ACTION TO COMBAT ACID RAIN. THE PRESENCE OF MY COLLEAGUES IN THE NEW YORK CONGRESSIONAL DELEGATION, GUY MOLINARI AND SHERWOOD BOEHLERT, TESTIFIES TO THE URBAN AND RURAL SUPPORT FOR SUCH ACTION. MY GOOD FRIENDS, STATE SENATOR JOHN DUNNE, FROM SUBURBAN LONG ISLAND, AND STATE ATTORNEY GENERAL BOB ABRAMS HAVE, THROUGH THEIR EFFORTS, AMPLY DEMONSTRATED A BIPARTISAN COMMITMENT TO COMBAT ACID RAIN AT THE STATE LEVEL AS WELL.

MR. CHAIRMAN, I AM HERE TODAY TO VOICE MY SUPPORT FOR H.R. 3400, THE NATIONAL ACID DEPOSITION CONTROL ACT OF 1983, WHICH I AM CO-SPONSORING WITH YOU. AND I DO SO PRIMARILY FOR TWO REASONS. FIRST, BECAUSE WE MUST ACT NOW TO ADDRESS THIS SERIOUS PROBLEM. SECONDLY, H.R. 3400 OFFERS US AN OPPORTUNITY TO DO JUST THAT IN AN EFFECTIVE, EQUITABLE AND POLITICALLY ACHIEVABLE WAY.

OVER THE PAST FEW YEARS, AN IMPRESSIVE BODY OF SCIENTIFIC EVIDENCE HAS BEEN ACCUMULATED, INDICATING FOR US THAT WHAT GOES UP IN THE FORM OF SULFUR DIOXIDE AND NITROGEN OXIDE EMISSIONS MUST COME DOWN. AND MUCH OF IT COMES DOWN HUNDREDS OF MILES AWAY, UNIMPEDED BY STATE, REGIONAL OR NATIONAL BORDERS. NO REGION OF THE UNITED STATES IS IMMUNE TO THE THREAT OF ACID RAIN.

MOREOVER, WE ARE ALL WELL AWARE THAT OUR CANADIAN NEIGHBORS, TOO, ARE SERIOUSLY AFFECTED BY ACID RAIN AND THAT THE HISTORICALLY GOOD RELATIONSHIP BETWEEN US AND THE CANADIANS, WHILE BY NO MEANS THREATENED, HAS BEEN RUFFLED BY THIS ISSUE. I AM CONFIDENT THAT ALL AMERICANS WOULD LIKE THE BEST POSSIBLE RELATIONSHIP WITH CANADA. THIS IS PARTICULARLY IMPORTANT TO MY CONSTITUENTS AND TO NEW YORK STATE; WE SHARE A BORDER WITH CANADA AND OUR SOCIAL, COMMERCIAL AND CULTURAL TIES ARE DEEPLY INTERTWIN

EQUALLY IMPORTANT TO ME, MR. CHAIRMAN, IS THE FACT THAT H.R. 3400 IS POLITICALLY VIABLE LEGISLATION. IN RECENT YEARS, WE HAVE SEEN A MULTIPLICITY OF ACID RAIN SOLUTIO

MANY OF WHICH WERE POLITICALLY UNATTAINABLE. QUITE FRANKLY, I HAVE BEEN CRITICIZED FOR REFUSING TO EMBRACE SOME OF THESE SOLUTIONS, BUT I HAVE STEADFASTLY REFUSED TO HAVE MY CONSTITUENTS MISTAKENLY BELIEVE THAT A SOLUTION WOULD BE EASILY OR PAINLESSLY ATTAINED.

IN CONTRAST TO SOME OF THOSE EARLIER PROPOSALS, H.R. 3400 RECOGNIZES THAT ACID RAIN IS A NATIONAL CONCERN. IT OFFERS US AN OPPORTUNITY TO ACHIEVE MEANINGFUL REDUCTIONS IN SULFUR DIOXIDE AND NITROGEN OXIDE OVER TEN YEARS WITHOUT IMPOSING UNDUE ECONOMIC BURDENS ON ANY ONE INTEREST OR REGION. IT IS LEGISLATION THAT OFFERS REAL, RATHER THAN ILLUSORY, HOPE TO MY CONSTITUENTS AND IT IS LEGISLATION THAT I CAN AND DO URGE ALL MY HOUSE COLLEAGUES TO SUPPORT.

IN CLOSING, MR. CHAIRMAN, I WOULD ONLY LIKE TO REPLY BRIEFLY TO THOSE WHO MAINTAIN THAT WE CANNOT AFFORD THE EXPENSE OF THE UNDERTAKING WE ARE DISCUSSING TODAY. BACK IN SEPTEMBER OF 1981, IT WAS MY PLEASURE TO HOST A BIPARTISAN DELEGATION OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY WHICH CAME TO LAKE PLACID, IN THE HEART OF THE ADIRONDACKS, TO FIND OUT HOW MY CONSTITUENTS FEEL ABOUT ACID RAIN. THE DELEGATION LEARNED THAT NEWS REPORTS OF THE IMPACT OF ACID RAIN, AND THE MISINTERPRETATION OF THEM, HAVE ALREADY BEGUN TO AFFECT THE TOURISM INDUSTRY ON WHICH THE REGION RELIES SO HEAVILY. AND THAT IS ONLY ONE SECTOR OF THE ECONOMY OF ONE REGIO I SUBMIT THAT WE CANNOT AFFORD TO WAIT ANY LONGER TO ADDRESS THE ACID RAIN THREAT. IT WOULD BE AN UNSPEAKABLE TRAGEDY FOR US TO WAIT UNTIL THE DAY AFTER THE LAST LAKE DIE

HAVING SAID THAT I HOPE YOU WILL INDULGE ME AS I REPORT THAT THE ADIRONDACKS ARE AS BEAUTIFUL AS EVER, OUR FORESTS ARE LUSH AND VERDANT, AND OUR CLEAR, CLEAN STREAMS AND LAKES CONTINUE TO OFFER UNEQUALLED FISHING AND RECREATION. THE ADIRONDACKS ARE, FOR FOUR SEASONS OF EVERY YEAR, AN IDEAL PLACE TO LIVE AND VISIT. I INVITE YOU, MR. CHAIRMAN, TO COME SEE FOR YOURSELF AND I INVITE ALL AMERICANS TO JOIN US IN SUPPORTING H.R. 3400 TO INSURE THAT THE ADIRONDACKS REMAIN THAT WAY.

THANK YOU.

Mr. WAXMAN. Thank you very much. By all rights we should be in your district and Mr. Boehlert's district. And I am sorry that we could not arrange to have the hearing there because it is the most appropriate place for us to look at the problem of acid rain where it is doing the most damage in the State of New York. I regret it and I have to take responsibility because I will have to leave to go to God's other great part of the country, Los Angeles, in a short period of time, and we will take you up on your offer as soon as it gets warmer.

Mr. MARTIN. I would like to point out that I understand why you could not. I certainly feel no sense of blame, because we understand, the object of this exercise, because we know how we are going to vote. We know how we feel about it, but the object of this exercise ought to bring as much as a broad spectrum on board. And I think you are doing that by having it here, quite frankly.

Mr. WAXMAN. Mr. Boehlert.

STATEMENT OF HON. SHERWOOD BOEHLERT, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. BOEHLERT. Thank you, Mr. Chairman. Mr. Chairman, members of the Committee, already acid rain discussions have become the most egregious example ever of everyone talking about the weather, but no one doing anything about it. In this case we can do something about it.

The seemingly endless debate on acid rain is absolutely unnecessary for, stripped to its bare essentials, the acid rain issue is one of the simplest Congress has to contend with.

Look at it this way: We have a clear problem. We know its cause. We know how to solve it. We have the know-how and the resources to solve it. The logic of those facts should lead inexorably to a single conclusion: we must eliminate acid rain now. But all we get is more talk.

Let us examine each of the facts I mentioned.

First, the problem. That it exists is not in doubt. Already 212 lakes in the Adirondacks are dead and another 256 require hospice care. And there is growing scientific evidence that acid rain is damaging our farms and forests as well as our lakes, further increasing the economic as well as the environmental costs of acid rain. No wonder then, that acid rain has been termed "chemical leprosy" and a "sewer in the sky."

The cause of this destruction is no longer in doubt. Acid rain is not created in heaven by divine Providence, but rather is manufactured here on Earth by we mortals. Report after report this year has linked acid rain to sulfur dioxide emissions. Those who have been arguing that action to combat acid rain should await further research have had the rug pulled out from under them. That point was brought home by the President's own Acid Rain Peer Review Panel. While acknowledging, quite correctly, that we still have a lot to learn about acid rain, the panel concluded that we know enough to fight the problem.

As the panel's vice chairman, William Ackermann, put it at a hearing in September before the Science and Technology Committee, on which I serve:

> It is in the nature of acid deposition that actions have to be taken despite incomplete knowledge. If we take the view that we must wait until the scientific knowledge is definitive, the accumulated deposition and damaged environment may reach the point of irreversibility.

Knowing the cause of acid rain, we also know the solution, cut sulfur dioxide emissions by about 50 percent, the cut mandated by H.R. 3400 and H.R. 4404, both of which I have cosponsored.

This cut could be achieved through the use of scrubbers or coal washing or other emerging technologies with minimal disruption to the coal industry.

As a Congressional Research Service report concluded in June:

> Technologies are available now or will be available in a very few years which can significantly reduce sulfur dioxide emissions without significantly reducing the efficiency of a plant or creating dislocations in the coal market.

There is no question that putting this technology to work will be extremely expensive initially, an investment of several billion dollars. But if we spread the cost of that investment equitably, as befits a national problem, and finance it over a 10-year period, we can afford it. The one mill per kilowatt hour fee envisioned in H.R. 3400, for example, would cost the average ratepayer only $6 a year. In the long run, that is likely to be less expensive than the cost of sitting back and watching the continued deterioration of our lakes and soils.

Finally, let me dispel one more argument used by those trying to stall action against acid rain, the assertion that we should not act until the Canadians do.

Even if the argument's premise were true, which it is not, the view is illogical. Lack of action by Canada would intensify not obviate the need for the United States to reduce its emissions.

But the point is moot because Canada has taken action, and indeed is far ahead of us. I have met personally with members of the Canadian Parliament, with Ontario Premier Davis and with Ambassador to the United States Gotlieb on this subject. They have informed me that Canada spends 10 times what the United States does per capita on acid rain research and development projects. And they pointed out that Canada cut its sulfur dioxide emissions by 27 percent during the 1970's, almost twice the United States cut during the same period. Furthermore, Canada has initiated a plan to cut emissions by another 25 percent by 1990.

So it is not logical arguments nor scientific doubts that prevent us from eliminating acid rain; it is only political fear and inaction. But we should fear the problem more than the solution.

I am sure most of us saw the recent program "The Day After." We watched a once beautiful American landscape turned overnight into a wasteland. Well, if this hearing were being held in the Adirondacks, I could show you a slower but just as devastating transformation. An area of unparalleled, pristine natural splendor is now the site of fishless lakes and thinning forests. That is a tragedy.

There should be no need to wonder whether there will be a "day after" for the Adirondacks. Congress simply has to summon the courage to act.

I urge the committee to report, H.R. 3400, or its strengthened counterpart, H.R. 4404, as soon as possible.

And I would like, in conclusion, Mr. Chairman, to acknowledge your leadership and that of my colleague and fellow-freshman, Mr. Sikorski, as well as other members of this panel. You are doing a splendid job. Now it is time for concerted action collectively. Thank you.

Mr. WAXMAN. Thank you very much for that testimony and for those very kind words. We are going to look forward to working with you to get this legislation adopted and passed into law. Thank you very much.

Any questions by any of the members of the committee?

Mr. SIKORSKI. Mr. Chairman, I just have one comment that Guy Molinari talked about the $6,000 per fish proposed study of David Stockman. That so-called analysis has never met the light of day or good judgment or logic. We understand it eliminates virtually every factor, so that the fewest pound of fish can cost the most amount and that is how he ended up with $6,000 per fish. It is like saying, Take David Stockman's brain cells eliminate those you do not agree with or think function efficiently, take that, divide that by how much he gets paid a year, and you can find a $6,000 per brain cell type of thing. That is the type of analysis it was. One utility funded report was done on acid rain, that blamed duckhunters for the acid rain problems, because they were shooting more than necessary and the ducks were not dropping their basic elements into the water to buffer the acid, and therefore duckhunters caused problems besides God.

So I want to make sure that people do not pick up the $6,000 per pound item. Thank you, Mr. Chairman.

Mr. WAXMAN. Thank you. That was a very interesting analogy for government expenditures in another area other than acid rain, and we may well evaluate the utility of that expenditure as well.

Thank you very much.

Mr. BOEHLERT. Thank you very much.

Mr. WAXMAN. We are pleased to have with us two of the outstanding leaders in the State of New York—the Attorney General of the State of New York, the Honorable Robert Abrams; and the chairman of the senate conservation committee, the Honorable John R. Dunne. Mr. Abrams, I would like to call on you first, if I might, to have your presentation.

STATEMENTS OF ROBERT ABRAMS, ATTORNEY GENERAL, STATE OF NEW YORK; AND JOHN R. DUNNE, CHAIRMAN, NEW YORK STATE SENATE COMMITTEE ON ENVIRONMENTAL CONSERVATION AND RECREATION

Mr. ABRAMS. Thank you very much, Congressman Waxman, Congressman Sikorski, Congressman Ottinger, Mr. Dodson. We here in New York appreciate enormously your coming here today to try to coalesce and support on behalf of this very important issue. To my left is David Wooley, assistant attorney general, who has spent considerable time over the last few years on my behalf, and on behalf of people of the State of New York to fashion a program of litigation and administrative effort as well as legislative change in this very crucial area.

I am appearing before you as the attorney general of the State of New York and I am also currently serving as chairman of the environmental committee of the National Association of Attorneys General. I want to thank you all for coming and being here and Congressmen Waxman and Sikorski, you in particular are to be commended for all of the extraordinary leadership and fine work you have expended in the development and presentation of H.R. 3400.

In my view this bill proposes a series of sensible and equitable compromises on the difficult issue of cost allocation and economic dislocation, which have prevented so far Congress from acting on the acid rain problem. New York and its people suffer heavily from acid rain. Its effects include respiratory problems, such as chronic bronchitis, contaminated drinking water supplies, the elimination of fish populations as well as harm to plants, buildings and monuments. As has been indicated earlier in this hearing, in upstate New York the fish population of some 212 lakes and streams have been irrevocably eliminated by acid rain, and hundreds of others are threatened.

Acid rain is a problem to which the attorney general's office has devoted substantial efforts in administrative proceedings and Federal court cases. But unfortunately our experience in the courts and in the Federal administrative agencies, under the existing Clean Air Act, has been very disappointing.

Even our successes in the area of tall stack regulation underscores the slowness and the inadequacy of the existing law to achieve meaningful acid rain reductions.

A comprehensive acid rain amendment to the Clean Air Act is therefore desperately needed.

H.R. 3400 addresses the acid rain problem by mandating a 10 million ton sulfur dioxide emission reduction by the year 1993. However, because new sources of sulfur emissions will be allowed by the bill, it will actually achieve a net reduction of only 8.7 million tons of SO_2.

Recently, the National Academy of Sciences published its long awaited and definitive analysis of the acid rain problem. The academy concluded that a 50-percent reduction in acid deposition is needed to prevent the damages of acid rain. A 12 million ton reduction from current emission levels, that Congressman Ottinger supports by way of an amendment, will achieve approximately 10.7 million tons of net reduction of SO_2, when we factor in the growth and new sources emerging between now and the effective dates of 1993 or 1994.

This figure is substantially closer to to 50 percent reduction that is urged by the academy. And so it is for this reason that I am urging the subcommittee to increase the sulfur dioxide reduction requirements of the bill from 10 to 12 million tons. With this change, I wholeheartedly support the passage of H.R. 3400.

Along with this endorsement, I urge that the subcommittee hearings and working sessions be scheduled for the earliest possible date in 1984, and that all members focus on achieving passage of this bill.

In the 5 years that I have been Attorney General, I participated in and witnesses numerous attempts to get national legislation to address this problem. Unfortunately, all prior efforts fell victim to disputes among various regions of the country, with understandable concerns over economic dislocation and how to allocate the cost of emission control.

We can wait no longer for a solution. It is time for flexibility. It is time for compromise in order to break the logjam that has prevented action on acid rain. The Waxman-Sikorski bill provides a financially and technically sound plan for achieving a dramatic reduction in acid rain. It contains sensible interregional compromises which enhance its chances for passage. Time is of the essence and any protracted debate will only play into the hands of those who oppose acid rain controls. I would quickly in the limited minute or so that I have, touch on two critical aspects of the bill, which have made it in my view the best vehicle for passage. Large scale reductions of SO_2 emissions can be achieved either by use of technological controls, shifting to lower sulfur fuel or a combination of the two.

Although fuel switching is generally the less expensive option, heavy reliance on it would result in a dramatic dislocation of coal production and jobs from one region to another. The Nation, as a whole, has a significant interest in avoiding this sort of economic disruption, job loss, and we must be sensitive to the impact on large numbers of coalminers whose jobs would truly be jeopardized.

For this reason and because chances of passing a bill without provisions to minimize job dislocation are minimal, I support the bill's requirement that a large percentage of the total emission reduction goal be achieved through technological controls.

The other major issue addressed by the Waxman-Sikorski bill, is the thorny problem of allocating costs. Traditionally, the Northeastern States have paid high prices in order to preserve clean air, only to have these efforts defeated by pollution that is generated by the low-cost power production of Midwest industry and its utilities.

It has, therefore, been argued that the most equitable means of correcting this imbalance is to require the pollutors to pay the entire cost of emission control. Other considerations, however, necessarily temper this admirable and obviously in a vacuum, equitable position. We in New York need these emission reductions as soon as possible, especially because some of the effects of acid rain are irreversible.

Only a 12 million ton emission reduction will fully protect our people and their environment and the fulfillment of this urgent need has been blocked by concern over electric rate increases in the Midwest. Since passage of strong acid rain controls is unlikely, without some type of cost-sharing provision, I have concluded that the limited cost-sharing mechanism contained in H.R. 3400 should be supported.

Several recent analyses have shown that the effects of this cost-sharing proposal will not be great in any one State. Recent polls show here in New York that New Yorkers are overwhelmingly in favor of comprehensive acid rain controls, even if it means an increase in their electric bills.

My office, the Attorney General's office, has consistently fought the utilities and fought for the consumers by opposing unjustified increases in electric rates and will continue to do so. In fact, I have been at this very table at Public Service Commission hearings doing just that.

Nevertheless, I believe that the environmental and health benefits to be derived from obtaining a major acid rain reduction quickly are so important, that the cost-sharing mechanism of this bill is acceptable.

I thank you again for this opportunity to come and address you on these very critical issues and I hope that your good efforts will not only bring about support for the legislation, but ultimate passage in it having been signed into law.

Mr. WAXMAN. Thank you very much, Mr. Abrams. Senator Dunne, it is nice to have you with us. We would like to hear from you.

STATEMENT OF HON. JOHN R. DUNNE

Mr. DUNNE. Thank you, Mr. Chairman, and members of the subcommittee. I wish to point out that with me is the counsel to the New York State Senate Committee on Environmental Conservation, Thomas W. Faist, and as chairman of that committee, I appreciate the opportunity to testify before your subcommittee on Federal acid rain legislation.

New York State is particularly sensitive to the effects of acid rain in our Adirondack park region in particular, and in other areas of the State as well. I am encouraged by your concern over this environmental threat.

Protecting the health and welfare of New York citizens and the State's economic growth opportunities, requires the effective regulation of the interstate transport of sulfur dioxide-nitrogen oxides. Acid rain cannot be addressed adequately without Federal involvement, and H.R. 3400 is, in my judgment, the broadest-based measure to date that deals with acid rain as a national problem.

You, Mr. Chairman, may recall having heard from us earlier this year when we sent on to you and your congressional leaders a joint resolution which had been unanimously adopted in both houses of the legislature, calling for an amendment to the Clean Air Act, doing specifically what you have done in your legislation.

While we in New York urge a Federal solution to the problem, we recognize that we, as a partial source of our own acid rain problem, must be willing to take action within our own State. Legislation addressing this acid rain problem was sponsored by the staff of the Senate Environmental Conservation Committee and introduced earlier this year in both houses of the State legislature.

The bill calls for reduced emissions on a statewide basis, and establishes a policy of no net increase in the maximum allowable emissions of sulfur dioxide and nitrogen oxide from major steam electric generating facilities that burn fossil fuel.

The previous speakers have detailed the particulars about the effect that acid rain has had on certain areas, and I will not cover that. That is included in my statement which I have filed with you. But I would like to just point out this one phase of the problem.

Upstate New York is heavily dependent on tourism for its economic base. If the sports fishing population continues to decline, along with the concomitant loss of other wildlife, hunting, fishing, and other recreational activities, and tourism will decline as well, a matter of serious concern to the upstate economy.

The State Department of Environmental Conservation estimates that half a billion dollars in direct expenditures are made annually by fresh water anglers in New York State. And using a conservative multiplier of 3, this translates to an economic contribution of $1½ billion annually. But the need for action has a constituency well beyond the sportsman. Acid rain ranks high on the general public's list of environmental priorities. The issue continues to receive widespread publicity and recent polls indicate an apparent willingness on the part of the general public to bear a share of the cost of protecting the environment.

Thus, a proposal that spreads the cost of curbing acid rain, such as the fee schedule of 1 mill per kilowatt-hour put forth in your proposal, would appear to be warranted.

My main criticism, however, of your proposal, would be that it mandates scrubbers and does not allow the flexibility to utilize or develop other forms of emission control. Furthermore, putting scrubbers on the 50 largest emitters does not necessarily guarantee that the most sensitive receptor areas will be protected. Perhaps other, more strategically targeted generators should be addressed.

A further consideration is that some of the plants that would be required to be retrofitted will become obsolete in the next decade. Requiring major capital investments in plants that will soon be decommissioned might not be justified.

The bill introduced in New York calls for reductions of sulfur dioxide and nitrogen oxide emissions from major steam electric generating facilities, and to my knowledge it is the only State legislation in the country calling for such reductions. The legislation requires 50 percent reductions in sulfur dioxide emissions to be phased in by the year 2000.

The major difference between this bill and your proposal is that the options in achieving the reductions would be left to the affected utilities, something that Congressman Sikorski has commented upon in the media. The importance of this point was emphasized in our public hearings held on our bill this past spring. Utilities asserted they should have the option of utilizing new technology, such as fluidized bed boilers, or turning to other alternatives that might be more cost efficient, such as coal washing, mixing of coals with varying sulfur contents, or limiting the operation of a polluting facility through the purchase of energy from another area.

I am a firm believer that Government should set policy goals, but that the means to achieve these goals are best left in the marketplace, provided there is followup by Government monitors to see that the purposes of those regulations are complied with.

I believe the reliance on coal as a boiler fuel will continue to rise in this country, and therefore, it becomes increasingly apparent that the controls and caps on emissions of sulfur dioxide and nitrogen oxides from fossil fuel burning electrical generating facilities is necessary.

A Federal solution is the preferred method to implement corrective measures. In fact, when my bill reached the floor of the State senate, several State agencies urged restraint. I have held the bill on the floor anticipating some Federal action. I am here today to urge the Congress to take that action promptly. The capital and operating costs of emission reduction are admittedly high, but what will be the cost of lost tourism, diminished fish and wildlife populations, structural repairs, reduced timber stands, and potentially human health care?

The most insidious threat of acid rain may well be the unknown cumulative effects of this phenomenon. We can no longer afford the cost of inaction. Acid rain could be another environmental time bomb akin to the improper disposal of hazardous wastes.

Dead trout in the Adirondacks may be an early warning signal of potential, irreversible damage to the ecosystem which sustains us all.

I pledge to you, Chairman Waxman, my solid support for Federal initiatives to amend the Clean Air Act which addresses the acid rain problem, and offer my assistance to you and the members of the subcommittee in gaining passage of your measure. We are holding a national conference on the problems of acid rain in Albany on February 7 and 8, 1984. That might give you an opportunity to stop there on your way to Lake Placid, and I would invite your involvement because this is going to call for some tough action, united action, from those of us who recognize this as a real threat.

Once again, I thank you for the opportunity to be here.

[Mr. Dunne's prepared statement follows:]

TESTIMONY BY N.Y.S. SENATOR JOHN R. DUNNE

Good morning. I'm John Dunne, Chairman of the New York State Senate Committee on Environmental Conservation and Recreation. I appreciate this opportunity to testify before the Subcommittee on Health and the Environment of the House Energy & Commerce Committee on federal acid rain legislation. New York State is particularly sensitive to the effects of acid rain in our Adirondack Park region and other areas of the State. We also recognize that we are both a source and a recipient of acid rain. Scientists have estimated that up to 25% of the acid deposition in the Adirondacks results from emissions in the state.

I applaud the efforts of Mr. Waxman and Mr. Sikorski on the mobilization of bi-partisan support in the Congress for H.R.3400, and am encouraged by the federal concern over this environmental threat. The problem of acid deposition is indeed nationwide in scope and of national and international significance. Protecting the health and welfare of New York citizens and the state's economic growth opportunities requires the effective regulation of the intrastate and interstate transport of sulfur dioxides and nitrogen oxides. Acid rain cannot be addressed adequately without federal intervention, and H.R.3400 is the broadest-based measure to date that deals with acid rain as a national problem.

While we in New York urge a federal solution to the problem, we recognize that, as a partial source of our own acid rain problem, we must be willing to take action within our own State. Legislation addressing this acid rain problem has been drafted by the staff of the Senate Environmental Conservation & Recreation Committee and has been introduced in both houses of the New York State Legislature.

The bill calls for reduced emissions on a statewide basis and establishes a policy of no net increase in the maximum allowable emissions of sulfur dioxide and nitrogen oxides from major steam electric generating facilities that burn fossil fuels.

But let me emphasize the impact of acid rain on New York State. The focus of the dispute in this State, perhaps in the nation, is the Adirondack Mountain region. 2.8 million acres of Adirondack lands were set aside by the New York State Legislature in the late 1800's and given protection under the "Forever Wild" clause of Article XIV of the New York Constitution. The Adirondack Park has since grown to encompass six million acres, by far the largest park preserve in the United States.

Our State Department of Environmental Conservation has found that 446 lakes, representing over 15% of the ponded water in the Adirondacks, have chronic pH conditions. 212 lakes have summer pH values of less than 5.0 and are generally unable to maintain any type of stocked or native sport fish populations. Of 217 high elevation lakes, those over 2,000 feet, 90% were found to be devoid of fish. Since fish are the food supply of predators such as the osprey, loon, mink and otter, these animals are no longer found in or around these lakes. Thus the ecological balance, or food chain, has been disrupted by acid rain.

The hydrogeology of the Adirondacks is such that the soils have little or no buffering capacity, that is they cannot neutralize the acids. Additional research shows that toxic metals such as aluminum and cadmium are leached out of the soils by acid rain. These metals tend to concentrate in the runoff and find their way into the lakes and streams, adversely affecting aquatic life. Apart from aquatic impact, the red spruce has been found to be particularly sensitive to acid rain in studies conducted in the Green Mountains by the University of Vermont and in a study on Whiteface Mountain by the Atmospheric Sciences Research Center at our own State University. Health concerns were voiced by the Massachusetts Executive Office of Environmental Affairs about the leaching out of heavy metals, such as copper and lead, from plumbing lines.

Upstate New York is heavily dependent on tourism for its economic base. Should the sports fishing population continue to decline with the concomitant loss of other wildlife, hunting, fishing, and other outdoor recreational activities will continue to suffer and tourism will decline as well. This is of serious concern to the upstate economy. Half a billion dollars in direct expenditures are made annually by freshwater anglers in New York State. Using a conservative multiplier of three, this translates to an economic contribution of $1.5 billion dollars annually.

The United States Environmental Protection Agency has reported that 95% of the rainfall acidity in the northeastern United States is due to sulfuric and nitric acids. Sulfur dioxide constitutes approximately 70% of acid rain. Over 95% of the sulfur emitted to the atmosphere in the eastern U.S. is anthropogenic in origin. While the National Academy of Sciences has refused to make a definitive statement, they came to the conclusion that there is no evidence of nonlinearity between emissions of sulfur dioxide and nitrogen oxides and acid rain.

The Academy report was reinforced by recent scientific testimony given at hearings conducted in November by the U.S. Senate Environment and Public Works Committee. These same scientists believe that sulfur dioxide emissions in the Midwest ultimately cause acid rain in the Northeast. Thus the critical issue in the current political debate is not whether emissions of sulfur dioxide and nitrogen oxides are a contributing factor to eventual acid rain in New York and elsewhere but whether emission controls and reductions, particularly in sulfur dioxide and nitrogen oxides, will bring about a decrease in acid rain. I believe the answer to this question is, "Yes."

Acid rain ranks high on the public's list of environmental priorities. The issue continues to receive widespread publicity and recent polls have indicated an apparent willingness on the part of the public to bear a share of the cost of protecting the environment. Thus, a proposal that spreads the cost of curbing acid rain, such as the fee schedule of 1 mill per kilowatt hour put forth in H.R.3400, would appear to be warranted.

My main criticism of H.R.3400 would be that it mandates flue gas desulfurization equipment and does not allow the flexibility to utilize or develop other forms of emission control. Furthermore, putting scrubbers on the 50 largest emitters does not necessarily guarantee that the most sensitive receptor areas will be protected. Perhaps other targeting mechanisms should be explored. A further consideration is that some of the plants that would be required to be retrofitted will become obsolete in the next decade. Requiring major capital investments in plants that will soon be decommissioned might be not justified.

The bill that I have sponsored in New York calls for reductions of sulfur dioxide and nitrogen oxides emissions from major steam electric generating facilities. To my knowledge, it is the only state legislation in the country calling for such reductions. The legislation requires 50% reductions in the sulfur dioxide emissions by the year 2000. Reductions in nitrogen oxides emissions would be based on the best available control technology.

The major difference between this bill and H.R.3400 is that the options in achieving the reductions would be left to the affected utilities. The importance of this point was emphasized in public hearings held on my bill this past Spring. By this I mean if fluidized-bed boilers are perfected in the next five years, utilities may turn to that or they may use other methods such as precombustion cleaning of coal, one or more combinations of blending different sulfur content coals, conversion of an existing boiler to a boiler capable of burning low sulfur coal, early retirement of a major steam electric generating facility, purchasing of electricity or steam from another area to lessen the operation of a polluting facility, and implementation of energy conservation measures to reduce the demand for electricity. I am a firm believer that government should set policy goals, but that the means to achieve these goals are best left to the marketplace.

I believe the reliance on coal as a boiler fuel will continue to rise in this country given the uncertain outlook on world oil production and the general discomfiture of the public with nuclear power. It becomes increasingly apparent that controls and caps on emissions of sulfur dioxide and nitrogen oxides from fossil fuel burning electrical generating facilities is necessary.

A federal solution is the preferred method to implement corrective measures. In fact, when my bill reached the floor of the State Senate, several state agencies urged restraint. I held the bill on the floor anticipating some federal action. I am here today to urge the Congress to take that action promptly.

The capital and operating costs of emission reductions are high. But what will be the cost of lost tourism, diminished fish and wildlife populations, structural repairs, reduced timber stands, and, potentially, human health care? Is not the most insidious threat of acid rain the unknown cumulative effects of this phenomenon?

I believe that we can no longer afford the cost of inaction. Acid rain could be another environmental time bomb akin to the improper disposal of hazardous wastes. Are dead trout in the Adirondacks serving as an early warning signal of potential irreversible damage to the ecosystem which sustains us all?

I pledge my solid support for federal initiatives to amend the Clean Air Act which address the acid rain problem. I offer my assistance to Chairman Waxman and the members of the Subcommittee in gaining passage of a federal acid rain bill.

Once again I thank the Chairman and members of the Subcommittee for the opportunity to present testimony. I stand ready to answer any questions that you may have at this time.

Mr. WAXMAN. Thank you very much for your testimony and for your very thoughtful evaluation. Mr. Sikorski, you have some questions?

Mr. SIKORSKI. Just two comments. Thank you, Mr. Abrams. I would like to import you to Minnesota next week for our hearing there.

There was a report done at the University of Minnesota on Minnesota's similar situation, a little over half a billion, about $600 million this year just from sports fishing, not tourism, just sports fishing. The fish issue relates to our Indian reservation subsistence fishing there, as well as commercial fishing, so it goes beyond just sport fishing.

But one report in the northeastern part of Minnesota, by the University of Minnesota, found that an early announcement of some fish reduction because of acid rain in a few lakes, less than five lakes, would have an immediate impact of 3,000 jobs and $40 million on the Minnesota economy because there are options in Canada and other areas. I would expect that your situation is very similar in terms of the New York economy and I think that is the response for people who ask why New York people and Minnesotans want to do something. It is to protect their own economic and environmental resources.

I wanted to make the point that the reason we do allow for those State options in terms of choices by the utilities in our State reduction plan of 3 million tons in H.R. 3400. The simple reason that we chose to mandate scrubbers on the dirtiest powerplants was that we know what we can get. We know it is the quickest, most ambitious of any of the proposals. We know we can get it by 1990. We took the knowledge of what we could get and the cost and put them into something definitive. That is why we end up with somewhat rigid standard for that 7-million tons. What States do under the 3-mil-ton program however, is totally open, and hopefully that will spur new technology.

Minnesota has a state plan that we are functioning under and that allows us, that kind of development of the marketplace and utility judgments.

Mr. DUNNE. I would just like to add a quick note, if I may, Mr. Chairman. I hope we will have the support of the Governor and the leadership in the Assembly with regard to our proposal. Despite the fact we recognize it is principally a national problem you fellows really have to solve. It is so critical to New York State, that I believe we must take the initiative, do what we can, if you will, to clean up maybe only 25 percent of the problem, but we have to do that. A lot is at stake here, and perhaps if we do something affirmative, it might spur some of the reluctant colleagues that we are trying to push to support H.R. 3400.

Mr. SCHEUER. Mr. Chairman, if I might add, that makes real sense, because under this proposal, New York would be required to reduce its SO2 emissions by 200,000 tons. That would—your bill would come close to doing that, so you are matching up what you would be required to do. You would just get it done quicker than under the Federal legislation and you reduce your emissions by that much, which too effects the Adirondacks. It makes sense.

Mr. WAXMAN. Thank you, Mr. Sikorski.

I want to call on Congressman Ottinger to ask any questions, but while I do that I am going to turn over the gavel to him to chair this hearing. I, unfortunately, have to leave and I want to apologize to the others who will be testifying later today and to Senator Dunne and Mr. Abrams, as well, for my leaving at this point. But I appreciate your being here and I appreciate the testimony we will receive later today which I will have a chance to review.

Mr. OTTINGER [presiding]. Thank you, Mr. Chairman, and I hope the weather in Los Angeles is as nice as we have here for you in New York.

I want to thank both of you for taking time out of your very busy schedules to be with us, and indeed Mr. Waxman had he really understood the political realities of New York, he would have had the two of you first and the Governor second.

Attorney General Abrams' support of this legislation, I think is tremendously significant. He has been one of the principal battlers for more reasonable electric rates. As he outlined in his testimony, he and I have fought battles against Con Edison excesses many, many times. His support of the national fee recognizes this as a problem which has to be resolved, which both the humanitarian and political realities dictate, be done on the basis of a national burden. This was tremendously significant and will be very helpful for the legislation.

I am used to seeing the Attorney General with his young daughter, Rachel. He went all over the State with her on his arm.

Mr. ABRAMS. She is discussing acid rain in school.

Mr. OTTINGER. She is a charming young lady. I expected her to testify with you this morning. Her distaste for acid rain equals your own, I am sure.

Senator Dunne, the legislation is balanced and it does allow the discretion you advocate with respect to the mandates for reductions in all the States of the country. The reason that we mandated scrubbers, and you might have technological alternatives. That is something that we all ought to look into. It is included in H.R. 3400. The reason we make specific prescriptions with respect to the 50 largest polluting plants in the country is to try and create the balance that will save jobs in the high sulfur coal producing areas. I do not think we can get legislation if we did not take that problem into account.

But I did want to point out to you that we will probably exhaust the limits of our ability to mine low-sulfur coal with the reduction provisions that we provided over and above the prescriptions for the 50-largest polluters. I did not know you were aware of that feature of the legislation. But the legislation does not just require the 50-largest polluters to put on scrubbers. It requires that each State proportionately reduce its contributions to acid rain by a very significant amount. And that is left to the discretion of the States and whatever technologies, whatever might be the least costly solution.

As I indicated in my testimony, in the ideal world, yes, we would just prescribe that there had to be reductions and allow those who pollute to bear the burden, but that runs into both equity problems and political problems, which I think would be inseparable so I hope we could have your support for some kind of compromise solution.

Mr. Dunne. That is implicit in my commitment to work with you and your chairman.

Mr. Ottinger. Do you have any further questions?

Mr. Scheuer. No.

Mr. Ottinger. We want to thank you very much for being with us.

We next have a very large panel of public interest and utility representatives, including a number of people that I have worked very closely with over the years. Robert Boyle is a senior writer of Sports Illustrated magazine, and one of the founders of the Hudson River Fishermen's Association, that has done a tremendous amount for cleaning up pollution on our great river. Kurt Anderson, environmental affairs, manager, New York Power Pool; accompanied by John Terry, senior vice president and general counsel of Niagara-Mohawk Power Corp., representing the utility industry. Dr. William Brown, director of Energy and Technology Studies of the Hudson Institute. George B. Davis, the executive director of the Adirondack Council. Mr. Michael Oppenheimer, senior scientist for the Environmental Defense Fund. I guess I should expose my own conflicts of interest. I am a member of the board of that particular very fine environmental organization. Robin Gordon, League of Women Voters, of New York State. I am a member of that, too.

We thank you all for taking time to be with us and for your contributions, and without objection your full statements will appear in the record. Because of our time limitations, we will subject you to the disciplines that we have to observe in the House of Representatives, and ask you to summarize your statements in 5 minutes or less. We will start with Bob Boyle.

STATEMENT OF ROBERT BOYLE, PRESIDENT, HUDSON RIVER FISHERMEN'S ASSOCIATION; KURT D. ANDERSON, ENVIRONMENTAL AFFAIRS MANAGER, NEW YORK POWER POOL; WILLIAM M. BROWN, PH.D., DIRECTOR OF TECHNOLOGY STUDIES, HUDSON INSTITUTE; DR. MICHAEL OPPENHEIMER, ATMOSPHERIC PHYSICIST, SENIOR SCIENTIST, ENVIRONMENTAL DEFENSE FUND; ROBIN GORDON, LEAGUE OF WOMEN VOTERS OF NEW YORK STATE; AND GEORGE D. DAVIS, EXECUTIVE DIRECTOR, THE ADIRONDACK COUNCIL

Mr. Boyle. Thank you very much, Mr. Ottinger. We always seem to meet when the fish are dying. It goes back 20 years. I hope it stops one of these days. And generally the utilities are responsible.

I have been concerned about acid rain for a number of years. I have written about the problem for Sports Illustrated. I have recently coauthored a book with my son, Alexander. And I am the president of the Hudson River Fishermen's Association, which has been involved in acid rain litigation in New York State. And I am speaking today on behalf of the Fishermen's Association.

I am not here to reinvent the wheel by dealing with the scientific causes and effects of acid rain, but I do want to say that the problem in this State is far more widespread and insidious than all but a few New Yorkers realize. The problem of acid lakes and ponds is not confined to the publicized Adirondack Mountains. Acid lakes are right on the doorstep of New York City and the Hudson Highlands, where I live, 50 miles to the north of this hearing room. The Highlands are composed of ancient granitic rock, that are just about as old as the rock of the Adirondacks, and just as lacking in buffering capacity against airborne acids.

It is a beautiful region. The Highlands include vast holdings, the Palisades and the State park system, Fahnestock State Park and the U.S. Military Academy, at West Point, since this country was born, during the Revolution. Millions of people visit the Highlands each year. The parks are among the most popular in the country. But I am sorry to inform you that a survey of 20 lakes and ponds done for the Fishermen's Association, the Environmental Defense Fund and Scenic Hudson by Dr. George R. Hendrey of the Brookhaven National Laboratory, showed that 11 of those 20 ponds were sufficiently acid to violate the State pH standard of 6.5 for drinking water. One of those ponds, Breakneck Pond, serves as the drinking water supply for a children's camp.

Many of these lakes had very low alkalinities. Third Reservoir and Breakneck Pond had essentially no alkalinity whatever. Additional testing by the Palisades Interstate Park System, which I alerted several years ago, essentially confirmed these findings and has also found that other lakes are endangered.

There is even more appalling news. Four of the five lakes in the Shawangunk Mountains, about 80 miles from here as the crow flies to the Northwest, North by Northwest, have been destroyed by acidification, while in the Catskill Mountains, the east branch of the Neversink River undergoes a dangerous acid pulse after snowmelt in the spring.

According to Dan Smiley and Paul Huth, who have been studying the Shawangunks, acidification of these lakes probably occurred between the years 1890 and 1920, and the sources of pollution were local in origin in their belief.

I mention local sources because there are some ignorant or self-serving New York politicians who may object to the Sikorski-Waxman bill on the grounds that the Midwest is solely to blame for the New York's problem. I am going to deal with the midwest in a minute. But New York also pollutes. And up until last year, the State administration in Albany played a very hypocritical game.

In 1982, Robert Flacke, then the Commissioner of the State Department of Environmental Conservation, disbanded the Bureau of Energy, which was a remarkable bureau in an otherwise lackluster agency, because the Energy Bureau had sought to control powerplant emissions as utilities converted from oil to coal under a long range State plan.

When I went to Albany to investigate the Bureau's demise, and related acid rain matters, I found department employees in fear of losing their jobs. As one said, "Everybody feels the fix is in for coal conversion without control." In the initial test case of coal conversion, the Fishermen's Association, EDF and Scenic Hudson sought to restrict sulfur dioxide emissions by Orange and Rockland Utilities when that company applied to start burning coal at two facilities on the Hudson River. Most of the pollution from the coal would fall on the nearby Hudson Highlands, where, as I noted earlier, eleven lakes and ponds are already so acid as to be in violation of the State's pH standard for drinking water.

Yet Commissioner Flacke ruled that Orange and Rockland could increase sulfur dioxide emissions by as much as 15,000 tons a year. He would dump on us right where we were already hurting. His decision still stands and the acid rain burden on the highlands would now be worse, were it not for angered town residents who have tied Orange and Rockland up in knots with local zoning laws.

But there is more to New York's hypocricy. In the fall of 1981, the DEC completed the final draft of a study, Cumulative Environmental Impacts of Coal Conversion. The final draft, which I have, was then turned over to the New York State Energy & Research Development Authority for publication. Mind you, the earlier DEC drafts had already been laundered in-house, but the published version made available for legislators and the public was very, very different from the DEC's final draft.

Any adverse impacts tbe coal burning would have on New York, neighboring States or Canada were minimized or completely eliminated. One brief example: The first of the DEC's findings on ecological impacts. I will quote it.

> The transportation and deposition of pollutants from air masses containing significant concentrations of combustion-related substances and their impact on the environment are of great concern in the management of New York's ecosystems. From coal fired powerplants, the primary pollutants of sulfur and nitrogen oxide, and the secondary pollutants which form from these gasses during airborne transport, may have serious effects on ecosystems.

[Deleted, censored, cut.]

Only one of a number of strategic cuts that were made, without knowledge, I might add, of Maurice Hinchey, the chairman of the Assembly Committee on the Environment.

Now, for the Midwest. At first I had a bit of difficulty with this bill because I thought some Midwestern interests were getting off easy. Allow me briefly, I will finish in a minute, to raise a point about the role of American Electric Power which operates plants in the Midwestern Appalachia.

In the early 1970's, AEP deliberately pioneered the tall stack policy of dumping on people far downwind. This created a clamor. In 1974 issue of Business Week Magazine, which is not exactly a branch of Friends of the Earth, did a cover story on Donald Cook, then chairman of AEP, which was entitled "Donald Cook Takes on the Environmentalists."

In the article Cook referred to scrubbers as monstrous contraptions, and said that they offered "horrible problems." He ran and supervised a $3 million advertising campaign, nationally, in which AEP savaged scrubbers and extolled tall stacks. All deliberately done by this management. One ad proclaimed that tall stacks dispersed gaseous emissions widely in the atmosphere so that ground level concentrations would not be harmful to human health or property. The ad then went on to deride "irresponsible environmentalists" who sought strict controls on emissions and accused environmentalists of "taking food from the mouths of the people to give themselves a better view of the mountain."

It is now clear that what AEP called harmless traces of emissions can be lethal to many forms of life. But even then Business

Week was questioning Cook's tactics in 1974. The magazine concluded its cover story, and I quote:

> Thousands of hours of litigation lie ahead, while researchers try to sort out the scientific evidence. Ten years from now, it may well turn out that AEP was right. In that case, Donald Cook will be remembered the way he wants to be, but the verdict of history is just as likely to go the other way. AEP will have failed to lend its technological powers to the solution of a serious health problem. Then Donald Cook will be remembered by many as a stubborn man, who on this question, was simply wrong.

There is no question now, almost 10 years later, that Cook and the AEP and others like him in the industry were wrong, dead wrong, and that is no pun. And I wish that somehow, some way, the management and stockholders of AEP could be severely penalized for this deliberate policy foisted on members of the American public. Along with many of the public, I am fed up with seeing errant, arrogant monopolies charge off their willful mistakes to ratepayers and taxpayers.

Mr. OTTINGER. Can I ask you to sum up?

Mr. BOYLE. For the bill make it 12 million tons of SO_2. We are uncertain about the figure for nitrogen oxide because they are essentially out of control in this country.

Mr. OTTINGER. Thank you very much. I am somewhat relieved because the last time we went and testified together, Mr. Boyle arrived at the scene with a decayed striped bass, which he put on the table. The panel then had to cope with it. It was dead, quite dead.

Mr. BOYLE. As I recall, you asked me to bring it.

Mr. OTTINGER. We would hear next from Mr. Kurt Anderson with the New York power pool and Mr. Terry from Niagara Mohawk. I do not know whether you both want to testify.

Mr. TERRY. I yield my time to Mr. Anderson.

Mr. OTTINGER. Very good. Mr. Anderson, we welcome you.

STATEMENT OF KURT D. ANDERSON

Mr. ANDERSON. Thank you. Good afternoon. My name is Kurt Anderson. I am environmental affairs manager of the New York power pool. The eight members of the power pool supply about 99 percent of the electric energy consumed in the State of New York.

The bottom line of my testimony is that today your subcommittee does not possess informed studies on the environmental effectiveness of additional reductions of sulfur emissions from powerplants. Before enacting a proposal that will result in increased electricity costs by up to $700 million per year in New York State, your subcommittee should ascertain the nature and extent of the alleged environmental damage and come to grips with the most reasonable, effective, and economical method that can be legislated to decrease the impact if the results show they are significant.

It is our concern that the approach in H.R. 3400 will not result in demonstrable environmental benefits, and while we are finding that out, hundreds of millions of dollars will be added to the cost of the basic energy source so needed by our economy, that is, electricity.

The electric utilities of New York State have taken a very active role in environmental protection, especially in reducing emissions of sulfur to the atmosphere. The State's 50 percent reduction, as cited by Governor Cuomo, in sulfur emissions was already achieved by 1980.

New York State is a leader in maintaining a high level of environmental quality. It has been achieved through a cooperative effort between Government and the industry base in the State of New York. The electric utility industry alone has spent well over a billion dollars on sulfur dioxide control.

Southeastern New York, as we have heard previously is supplied by very expensive electricity generated from costly 0.3 percent sulfur oil. That is about the most expensive fuel you can use to generate electricity. Then we have the electric rates that are the highest in the country in this part of the State.

Again, environmental controls contributes to that very high cost. Acid precipitation legislation, H.R. 3400, would increase the cost of doing business and be antithetic to economic recovery and expansion in this State. Senator Moynihan noted that also.

Since New York has already achieved a 50-percent reduction in their emissions by 1980, further reductions from that benchmark cited in the legislation will be considerably more difficult and expensive.

H.R. 3400 will increase cost for electricity in New York State and we estimate that cost is in the order of $170 to $700 million per year in current dollars. In addition, the 1 mile per kilowatt-hour assessment would additionally increase those costs by $100 million per year.

Turn now to another item, section 193 of H.R. 3400 may be interpreted to require each source or unit to reduce sulfur emissions by a single percentage legislated for the State. The only way generating units in New York which are already required to use extremely low-sulfur residual oil could get those reductions would be; convert to either natural gas or distillate oil. Such conversions would greatly perturb the home heating fuel market.

Additionally, strategies to achieve reductions could be either to purchase low-sulfur fuel or to install flue gas desulfurization equipment. FGD systems produce large amounts of sludge. And implementing H.R. 3400 may be very difficult because of the nonpreemption of H.R. 3400 for disposal problems. Mr. Boyle just alluded to the tying up, if you wish, of Orange and Rockland Utilities. One of the reasons for tying up was the solid waste disposal issue.

Studies by the New York power pool based on our lowest cost dispatching capabilities, conclude that one means of achieving sulfur dioxide reductions would be to increase the use of low-sulfur oil in the State. Acid rain legislation would then equate to increased imports of oil, even though State and Federal policy are against this.

Remind yourselves that New York State is 59 percent oil-dependent in our generating capacity.

I bring to your attention two questions that pose very serious public policy issues. What is the cost to the public and will the environment be improved? I hope you will seriously consider those items.

New York utilities actively support national environmental research and local research in the State. We have environmental specialists within the utility organization in this State and we are most cognizant of the status of the science concerned with acid precipitation.

Broad reviews of the scientific understanding have been done by some of the national organizations. However, a reading of those scientific discussions all point to the need for additional knowledge. Scientific investigation to date indicates that our croplands are not endangered. Scientists also note that the impacts of acidity on our forests, although far from being understood, do not indicate widespread and demonstrable impacts.

Acids from the atmosphere do supply nutrients to our forests. In fact it is a major form of getting nutrients to the trees.

Impacts on public health, if any, are speculative. The interagency task force notes that. Impacts of acidity on structures and outdoor art have been alleged, but with a combination of sources it is hard to identify what part acid precipitation may play.

An issue that has been recently cited and was cited this morning is the long-range versus local source impact issue. New York State has decreased emissions by 50 percent over the last decade plus a few years. If the short-range or local sources were that important, we should have had demonstrable effects. However, studies by U.S. Geological Survey that have measured a number of streams in New York over approximately two decades, detect no significant change in pH levels over that period.

Mr. OTTINGER. Could I ask you to summarize your statement?

Mr. ANDERSON. Yes, I will. Governor Cuomo has recently announced a cooperative effort with the utilities in the State to get at the root and get some facts and figures. We are going to look at 1,200 Adirondack lakes. So we know what the situation is with those lakes, both the chemistry and fisheries.

Mr. Chairman, there is considerable uncertainty whether a proposal to drastically decrease sulfur emissions from powerplants will have any beneficial effect. On the other hand, the huge cost and economic impact of implementing such emission reductions is obvious. Therefore, the member systems of the New York power pool urge that enactment of the type of legislation being considered by this subcommittee await better scientific understanding.

We also urge Congress to support two things, to better ascertain the nature and extent of environmental damage, and better define the most reasonable, effective, and economical way of decreasing the environmental impacts if and where they are significant.

We are very deeply concerned that the bill's approach of mandating decreased emissions will not result in demonstrable environmental benefits, but will significantly increase the cost of a basic energy source, electricity, that is so vital to our economy. Thank you.

[Mr. Anderson's prepared statement follows:]

STATEMENT OF
KURT D. ANDERSON

BEFORE THE SUBCOMMITTEE
ON HEALTH AND ENVIRONMENT
OF THE HOUSE COMMITTEE
ON ENERGY AND COMMERCE

December 1, 1983

Committee Members, Ladies and Gentlemen:

My name is Kurt D. Anderson. I am the Environmental Affairs Manager for the New York Power Pool, the eight members of which supply 99 percent of the electric energy used by industry, commerce and the residents of New York State.

The bottom line of my testimony is that today your Subcommittee does not possess informed studies on the environmental effectiveness of additional reductions of sulfur emissions from power plants. Before enacting a proposal that will result in increased electricity costs by up to $700 million annually in New York State, your Subcommittee should ascertain the nature and extent of the alleged environmental damage and come to grips with the most reasonable, effective, and economical method that can be legislated to decrease the impact, if the results show they are significant. It is our concern that the approach in H.R. 3400 will not result in demonstrable environmental benefits; and while we are finding out that is the case, hundreds of millions of dollars will be added to the cost of a basic energy source so needed by our economy--electricity.

The New York Power Pool's members are the State's seven investor-owned electric utilities and the New York Power Authority. The electric utilities of New York State have taken a very active role in environmental protection, especially in reducing emissions of sulfur to the atmosphere. In fact, the state's 50-percent reduction of sulfur emissions was achieved by 1980; and in New York City, there was a 90-percent reduction.

New York State is a leader in maintaining a high level of environmental quality. This has been achieved through a cooperative effort between the government of New York State and the industries in the state. The people of the state have sanctioned billions of dollars in bond issues to improve environmental quality, and industry has spent billions of dollars to achieve the same goal. In fact, the electric utility industry alone has spent well over a billion dollars in sulfur dioxide control.

Southeastern New York, where approximately 70 percent of New York's population resides, is supplied in great part with electricity generated from costly 0.3 percent sulfur oil, the cleanest residual oil available for electric power production. The three electric companies servicing south-eastern New York have the highest electric rates in the

Nation, and control of sulfur dioxide is a significant part of that high cost.

The high cost of electricity is a major concern to consumers, business, and industry throughout New York State, especially regarding jobs and job development. Additional costs that would have to be borne as a result of the proposed bills addressing acid precipitation would further increase costs of doing business and be antithetic to economic recovery and expansion in this State.

Most of the acid rain bills being considered would require emissions of sulfur dioxide to be reduced ("rolled back") from a 1980 bench mark. Since New York had already achieved a 50-percent reduction in emissions by 1980, further reductions from that bench mark will be considerably more difficult and expensive in New York than in other states where SO_2 emission rates are much higher. New York's fossil-fired utility boilers emit, as an average, only 1.4 lbs. of SO_2 per million BTU's of heat input. Other states emit 3 or 4 times this average. By not giving credit for pre-1980 reductions, the bills would actually penalize the people of New York for their pre-1980 achievements.

The member systems of the NYPP have estimated that the reductions proposed under H.R. 3400 would result in increased costs for electricity in New York State between $170-700 million per year (in current dollars). The one mil per KWH assessment would cost an additional $100 million per year. The wide range of these increased cost estimates reflects the uncertainty of the cost of fuels, as well as how the state may elect to allocate the SO_2 reductions, assuming the State has the flexibility to make such allocations.

Section 193 of HR 3400, as drafted, may be interpreted to require each source or unit to reduce sulfur emissions by a single percentage legislated for the State. The only way generating units in New York which are required to burn extremely low sulfur residual oil could achieve such reductions would be to convert to natural gas or distillate oil. The necessity to use distillate oil or gas in these utility boilers would greatly perturb the home heating fuel market, because it is unlikely that adequate supplies of these fuel will be available.

Strategies to achieve reductions could be either to purchase low-sulfur fuel or to install flue gas desulfurization (FGD) equipment. FGD systems produce large amounts of sludge--which must be disposed of on land. Implementing H.R. 3400 would appear to require that FGD be installed at some generating stations, but the bill does not preempt state and local landfill siting laws. Experience suggests, therefore, that completion of these FGD installations will be seriously delayed by local litigation over siting of sludge disposal landfills. Without preemptive federal landfill siting provisions, the bill's 1993 deadline may be difficult or impossible to meet.

Studies by NYPP, based on least cost dispatching, conclude that one means of achieving SO_2 reductions would be to increase the use of low-sulfur oil in the state. We are particularly concerned, however, that acid rain legislation would then equate to increased imports of oil, even though federal and state policy is to reduce oil dependence. Our generating capacity in New York State is heavily dependent on oil, since 59 percent of our present installed capacity burns oil.

The member systems of the NYPP provide the lowest-cost electricity possible, given the constraints of law and economics. Increasing the cost of electricity in New York through the use of low-sulfur fuels or sulfur removal equipment poses very serious public policy issues:

1. What is the cost to the public?
2. Will the environment be improved?

The New York electric systems, through their support of research on the environmental impacts and causative mechanisms of acid precipitation, are very skeptical whether the causes and effects of acid precipitation are understood sufficiently to make informed policy judgments at this time. The New York companies actively support national environmental research through the Electric Power Research Institute, and also support a $4 million/year local research effort through the not-for-profit Empire State Electric Energy Research Corporation. It is through the latter organization that the New York companies conduct research on environmental issues of particular interest to New York State. Acid precipitation research takes up a very large portion of our environmental research budget, and environmental specialists within the New York utilities are most cognizant of the status of acid precipitation science.

Broad reviews of the present scientific understanding of the causes and effects of acid rain done by the National Academy of Science, EPA, and others cite the lack of information to make firm conclusions. Industry discussions with many scientists actively engaged in acid precipitation research are not able to support the wide-scale "death and destruction" allegations of the more extreme proponents of the legislation.

Scientific investigation indicates that the impacts of the acidity in rainfall on our croplands is minimal, especially when compared to normal acidic fertilization practices. Scientists also note that the impacts of acidity on our forests, while being far from understood, seem to indicate that there are no widespread and demonstrable impacts. In fact, acids from the atmosphere supply some of the nutrients necessary for healthy tree growth. The impacts on public health, if any, are highly speculative. Competent medical reviews do not bear out any significant health impacts. The Interagency Task Force on Acid Precipitation notes that mechanisms exist for health impacts, but there is no evidence that such impacts occur. Impacts of acidity on structures and outdoor art have been alleged, but there is little understanding of the extent that is due to acidity in precipitation versus that which occurs as a result of freeze-thaw cycles and chemical attack from other sources.

Another issue recently cited in the controversy is the long range versus local source impact issue. New York has decreased sulfur emissions by 50 percent, which should have had a demonstrable affect if local sources are serious impactors on water quality. Studies by the United States Geological Survey, that measured the pH of various watersheds in New York State since the mid-1960's, detected no significant change in the pH of these watersheds over the nearly two decades of measurement. Obviously, more study is needed before this issue is understood, but in any case the data does not suggest that the situation is deteriorating, or that draconian legislation, such as H.R. 3400, is needed.

This then leaves the issue of acid precipitation impacts on our aquatic environment, an issue that is still of considerable concern. The Adirondacks are usually asserted to be an area of high impact from acid deposition. The Adirondacks have approximately 2,750 lakes and ponds. Only about one-third of those lakes and ponds have been chemically sampled, and even that sampling is of rudimentary character. The media reports widespread destruction of these lakes while, in fact, only about one-third of the lakes have had the most cursory chemical tests made on them. Results of those tests show that less than five percent of the lake acres in the Adirondacks have acidity levels classified as critical. I might note that many of those lakes that are classified as critical; e.g., having a pH of less than five, do have fish in them. I bring this to your attention since much of the debate revolves around the alleged impacts. I use the term "alleged" because we have not yet defined either the nature or extent of aquatic impacts. It seems reasonable that a better understanding of the magnitude of the problem is necessary before effective action can be taken. Understanding and defining the problem before proceeding with a solution is a basic precept of science, technology, and public policy-making. In keeping with this precept, the New York electric systems will continue to be active participants along with the State of New York in gathering the facts needed for informed decision-making.

As recently announced by Governor Cuomo, the New York State Department of Environmental Conservation and the electric utilities will jointly fund a $4 million effort that will measure the chemical quality and define the fish populations in 1,200 of the Adirondack lakes over the next three years. We have already determined from limited detailed scientific studies over the last three to five years in the Adirondacks that each watershed and lake or pond within that watershed is unique. The chemistry of the two score lakes that have been extensively studied shows wide variations due to the minerology of the soils, the hydraulic characteristics of the watershed, and the types of forest cover. Additional work is needed before generalizations can be made as to the susceptibility of certain waterbodies to acidification processes. Scientists have shown that adjacent lakes separated only by a hill can have completely different characteristics and differences in acidity range by a factor of approximately 100 over a distance of one mile.

Because of the electric industry's concern over additional costs, because of our record in significantly reducing SO_2 emissions in New York State, and because of our active participation in research, the New York utilities seriuosly question the advisability of proceeding with acid precipitation legislation at this time. We hold the view that the existing scientific studies are sending very confused signals about the significance acidity's role plays as a source of deleterious environmental impacts. We urge that additional facts be ascertained.

Mr. Chairman, there is considerable uncertainty whether the proposal to drastically decrease sulfur emissions from power plants will have any beneficial environmental results. On the other hand, the huge cost, and economic impact of implementing such emission reductions is obvious. Therefore the member systems of the NYPP urge that enactment of the type of legislation being considered by your subcommittee should await a better scientific understanding. We also urge Congress to support additional scientific research to: (1) Ascertain the nature and extent of environmental damage and (2) Better define the most reasonable, effective, and economical way of decreasing the environmental impacts, _if_ and where they are found to be significant.

We are deeply concerned that the bill's approach, of mandating decreased emissions, will not result in demonstrable environmental benefits, but will significantly increase the cost of a basic energy source - electricity - so vital to our economy.

We thank you for the opportunity to appear before you and to present our views. I would be happy to answer any questions that you may have.

Mr. OTTINGER. We thank you.

And I would hear next from Dr. William Brown, of the Hudson Institute. Last time I was with Dr. Brown, some 4 years ago, he astounded members of the Science and Technology Committee that went to visit him at the Hudson Institute by predicting that there would be a glut of oil on the market at a time when shortages seemed inevitable and would persist.

We welcome you to the committee and we welcome a summary of your testimony.

STATEMENT OF WILLIAM M. BROWN, PH.D.

Dr. BROWN. Thank you, Mr. Chairman. My name is William M. Brown. I am the director of technology studies at the Hudson Institute, a not-for-profit policy research organization, and located in Westchester County.

In the few minutes allotted, I would like to portray a somewhat unconventional image of the effects of acid rain on aquatic systems. This image has emerged from a recently completed study of ours, a summary of which is being submitted for your perusal.

Now, I have found, and I believe you have, that scientists completely agree that acidified aquatic systems are hostile to fish and other creatures that live in the waters. There is considerable disagreement, however, about where the acid comes from. The belief that is common, that acid rain runs off from watersheds and increases the acidity in streams and lakes, is both simple and clear, but unfortunately is almost certainly wrong. Rain and melting snow must filter through various soils of the watershed on their way to streams and lakes, but these are not neutral filters. Below the forest litter lies a layer of humus which naturally contains and continually produces acid, and usually much more acid than exists in the rain falling upon it.

Eastern rainfall on average contains about 4 parts per million of acid, called a pH of 4.1. Using the normal precipitation of 36 inches per year, it follows that each square foot of the watershed area of the State receives about one-eightieth of an ounce of strong acid per year. The amount is trivial compared to that produced by the forests, whose naturally acidic humus layers are from a few inches to perhaps several inches thick, and which contain roughly a thousand times as much acid as is received annually from the acid rain which falls in the forest. As a result, any rain filtering through these layers will emerge acidic whether or not it originally contains any acid. Moreover, the acidity which emerges will usually be much greater than the 4 parts per million of the acid rain.

Now in most watersheds, however, subsequent lower levels through which the runoff percolates is porous alkaline rock, which neutralizes the acid before the runoff can enter the lakes and streams.

However in a few regions these deeper filters are mostly of granite or other minerals that lack the ability to neutralize acid. Lakes in such areas, therefore, are naturally acidic, a result which is not affected significantly by the emissions of our industrialized society.

To emphasize this point, almost all lakes in forest areas would be acidic and devoid of fish for natural reasons if the underlying mineral soils were not usually of an alkaline nature.

You might ask why have some lakes lost their fish populations and become more acid over time? Well, that question poses a more complex problem, with many possible explanations, but very little accurate information. As good data about changing local conditions over the past decades is generally not available, accordingly we are left to rely on informed judgments. One answer may be that present forests and aquatic systems are stable nearly everywhere. Other answers were suggested in an earlier paper in 1982 entitled Alternative Explanations for Aquatic Ecosystems Effects Attributed to Acid Deposition.

Of the many possibilities, I would like to describe one which is related to past forest fires, and which I find impressive in general terms. Almost all of our forests have been either accidentally or deliberately burned down at least once during the last century or two. Those fires often destroy the acidic organic layers of the forest soil, leaving instead a layer of alkaline ash in their place, and they also destroy the forest's natural acid production mechanism, for several years at least, until the forest has regrown.

Now, it is not known how long it takes the ecosystem to recover completely from such a disastrous event, but it is at least a few decades. During this interim period, lakes in the sensitive areas, should be considerably less acidic than normal and more hospitable to fish. But eventually the acidity returns, as the forest regrows, and the alkalinity is depleted, and normal acidity will be restored.

The U.S. Forest Service has intervened in recent decades in order to reduce forest fires. They were successful. For example, the standing stock of forests in the New England area has increased by 70 percent in just 25 years between 1952 and 1976. Unfortunately, they also succeeded thereby in increasing the acidity of the forest soils. Should we not also blame the Forest Service for increasing the natural acidity of the soils and therefore killing the fish?

Mr. OTTINGER. I have to ask you to wind up.

Dr. BROWN. I am almost through. This presentation is focussed on the relatively small number of acidified aquatic systems and the questionable assertion that it derives from industrial emissions. The evidence that I have presented to suggest a natural source of acidity is responsible for that condition is not my own. It was taken from recent papers by soil scientists who have no political axes to grind.

One of the most persuasive of these publications by Edward Krug and Charles Frink of the Connecticut Agricultural Experimental Station, appears as a leading article in Science Magazine on August 5, 1983. I have a copy available if you are interested, a reprint, and I urge your technical staff to study it carefully.

So far I have only mentioned acid rain in connection with fish. Our studies dealt with several other aspects of this issue. The executive summary and conclusions are available here today and are submitted for your record.

I would like to close by stating just one of our conclusions. The dilemma facing the Congress that the presently proposed acid rain legislation will have the following characteristics. After compliance with the legislation is complete, if it is passed, it is not certain that any change in the measured amount of acid deposition in the sensitive eastern areas would be observable. Second, if it is observed and found to be significant, for example, a 20-percent decline, then it is not certain that any of the desired impacts on aquatic or forest ecosystems will be observed. Third, the only certainty is that the economic and social costs will be large.

I thank you, Mr. Chairman. I would be happy later to answer any questions.

[Testimony resumes on p. 110.]

[Dr. Brown's prepared statement follows:]

Prepared Statement of William M. Brown, Ph.D.

A PERSPECTIVE ON CURRENT ACID RAIN ISSUES

I. INTRODUCTION

It has long been known that rain, snow, hail and other wet precipitation from the atmosphere has been acidic. Indeed, the term acid rain was coined over a hundred years ago when rain was first tested in England and found to have considerable acidity. In the less inhabited parts of the world, especially those far from industrial centers, presumably the precipitation is not polluted by anthropogenic emissions and the acidity should generally be less than one part per million (ppm). Although rainfall in a pristine environment, theoretically, would have an acidity of 0.1 ppm approximately (a pH of 5.6) that is seldom actually experienced. Indeed, rainfall with acidity greater than 1 ppm has been reported in many distant parts of the world such as remote Hawaiian Islands or even, as recently reported in the Wildlife Digest, over the tropical forests of southern Venezuela which are part of the Amazon Basin. The causes of such remarkably high rainfall acidity in such places is not yet known.

In recent years concern about acid rain--or, more technically, acid deposition--has become both a national and international issue. Claims have sprung up that various local environments or ecosystems are being damaged to a greater or lesser degree by the acidity in precipitation and some assertions even now are being made that the damage wrought might become irreversible. If these claims are substantiated by the ongoing scientific investigation then the potential environmental and ecological damage might indeed be quite significant, as also might the economic value of the various forms of damage. To date, however most of the claims about the sources and impact of acid rain are still somewhat uncertain, and in many aspects highly uncertain, if not simply wrong.

In the United States scientific calculations have shown that the contribution of anthropogenic emissions from various sources, but primarily from industrial and electric utility plants, have contributed over 90 percent of the acidity to rainfall in the eastern portions of the United States. Averaged annually the resulting concentration of acid in U.S. precipitation does not exceed 4 ppm (parts per million) in any state. Although such amounts are quite dilute, in the sense that it would not be noticeable in drinking water, for example, nevertheless 2-4 ppm is an acidity level which apears to be harmful to various forms of aquatic life. However, because most lakes and streams in this country have natural alkaline buffers the impact of the precipitation is negligible in the vast majority of lakes and streams. Whether it even has much of an impact on those waters which are poorly buffered is also in doubt, according to many investigators, as will be shown.

The extreme concern about the potential danger from acid rain has led to an increased amount of scientific research which, hopefully, will lead to definitive answers in the near future. Such research is now being carried on by scientists in several developed countries and is being principally supported by the governments of Europe and North America. In the U.S. it has become an important project for the Environmental Protection Agency (which leads an Interagency Task Force), the National Academy of Sciences, the Office of Technical Assessment. Also, major studies have been conducted by the Library of Congress, the Department of Energy and many state environmental organizations, as well as by various utilities and utility associations.

Our study has been commissioned by the Hoosiers for Economic Development Committee with the understanding that we will provide an independent perspective on the current issues and the currently proposed legislation for controlling the emissions of acid rain precursors--sulfur and nitrogen oxides, primarily. At the outset the Hoosiers Committee understood that the perspective that we would develop would depend entirely upon the evidence gathered and that the Hudson staff had no meaningful connections to any of the antagonists or protagonists that are involved in the ongoing political debates.

Our approach has been relatively straightforward. We have attempted to review the evidence about the sources, transport, and deposition of potentially acidic emissions from man-made sources through the atmosphere and back to the surface. Second, we have examined the claims about possible damage which can occur and the evidence given in support of those claims. We have also looked at arguments which contradict those assertions or find them exaggerated, or conclude that the evidence is only circumstantial and that other causes of the damage should be investigated.

We also have briefly looked at the various claims about the costs of controlling the emissions of acid precursors and tried to make a rational judgment about the reasons for the wide variations in these estimates. Also we examined the issues from various political perspectives in order to provide the reader with some background about the political process and how it might affect the outcome of the proposed acid rain legislation.

Finally the conclusions and recommendations which appear in this report are those of the authors who, in arriving at them, take a point of view that is intended to represent the national interest. That is we give relatively little consideration to the needs or goals of any special interest groups. Obviously some of our conclusions or recommendations will not be welcomed by some of these groups. Where there is disagreement we hope it will be understood that the disagreement represents an honest difference of perspectives, judgments or opinions.

II. EXECUTIVE SUMMARY AND OVERVIEW

Currently at least several hundred scientists around the world are involved in debates about various technical issues related to acid rain--at least the portion of it which stems from anthropogenic (man-made) sources. Here are some of the issues:

1. How much acid is produced? There is general agreement that the burning of hydrocarbon fuels (coal, oil, natural gas, wood, paper, in the U.S., etc.) creates emissions which contain about 25 million tons of sulfur oxides, 20 millions tons of nitrogen oxides, and smaller quantities of other less important acid precursors. A fraction of these will end up as acids in the atmosphere (primarily sulfuric and nitric acids) probably within a few days. How much of these emissions actually is converted into acids is not known, although it is undoubtedly a substantial fraction. Because the amount of acid formed depends upon many capricious meteorological factors (winds, clouds, temperature, humidity, rainfall, sunshine, turbulence) as well as atmospheric dust, time of day, season, and possibly many other non-meteorological factors (not all of which are even known) that amount is undoubtedly a highly variable quantity over time. Long-term averages, when they become determined over time by enough research, might show that roughly half of the emitted precursors eventually become acids--but that is only a guess, not a solid scientific fact. A few years of an adequately funded research program should provide a respectable answer to the question.

2. How much acid precipitation reaches the ground in the geographical areas which many people have claimed are relatively sensitive? Here again the answers are not precise, in part because of the extreme variability of the measured results. In a single rainstorm the acidity can vary greatly--by a factor of 4 or more--over the region receiving the precipitation. In fact, the measured acidity of rain at any single receptor can also vary by a similar factor during the course of a storm. It does not necessarily follow that the acidity is greater at the beginning than at the end of a storm, or the other way around. There are no simple answers to those questions.

Some of the acid formed in the atmosphere may reach the ground as "dry" precipitation. That usually means in other ways than through rain or snow and includes fogs, direct contact with surface features, and oxidation to acids of gaseous precursors after they are adsorbed onto various surfaces. Also, a portion of the acid formed is neutralized in the atmosphere or on the ground, and another portion is dissipated in the ocean.

Research efforts are now underway to provide better quantitative information about the amount of acid precipitation received in various regions of the U.S. but it will probably take a few years before high confidence can be placed in the accuracy and usefulness of the knowledge gained. Even then it is probable that knowledge about the amount of dry acid deposition will lag that of wet deposition--perhaps for a considerable time.

3. How much of the acid deposition in any particular area comes from sources which are local, how much from nearby emissions (e.g., within 200 miles), and how much comes from distant sources, several hundred miles distant or more? Currently this issue is especially important because the sources of sulfur oxide emissions that are obvious targets for regulatory control are the large coal-burning power plants which are relatively concentrated in the mid-western states while the areas claimed to be the most sensitive to acid rain are in the Adirondack Mountains of upstate New York and parts of southeastern Canada.

At the present time, even though the legislation now being proposed in Congress focuses on controlling SO_2 (sulfur dioxide) emissions from mid-western utilities, it is not known whether that program will make a significant change in the amount of acid deposition in the Adirondacks. Indeed, it would not be at all surprising to find that the program made only a barely noticeable change in the measured amount of acid rain in upstate New York even after 10 years and a commitment of $100 billion (in 1982 dollars).

On the other hand it may be possible, though not likely, that the same program could reduce the amount of acid precipitation in the Adirondacks by as much as 25 percent. However even with that favorable outcome would the effects of that change in deposition be noticeable? That is, would fish appear or be able to survive in some of the lakes which are now barren of them? Would some forests which now appear to be dying become revitalized? As we shall see, there is a very great uncertainty about achieving any observable results even under favorable assumptions about the change in the amount of acid deposition.

4. Do scientists now reasonably understand the effects of acid rain upon various parts of the environment? This may be the most important technical issue. That is, how bad is acid rain? What damage is it doing? Will it get worse over time?

A substantial part of this report will deal with those questions in some detail. We can summarize the answers that are now being given by scientists in the following way. The scientific community is strongly polarized at present. Many scientists tend to believe that acid rain is responsible for the loss of fish in some lakes and other undesirable aquatic effects in the more sensitive areas; that it poses threats to some kinds of forest in some regions; and that it has potential deleterious effects on human health as well as accelerating erosion or corrosion on exposed buildings, monuments, and vehicles. However they usually concede that the evidence is circumstantial--that is, other explanations for the observed effects, while not known, cannot be ruled out.

On the other side of the damage issue we find scientists who claim that the acidity of lakes and streams even in the most sensitive areas are due to natural causes, sometimes with an assist from past land-use practices (such as logging, fire control). In particular, they assert that the acidity of lakes and streams is almost completely determined by the soil conditions of the associated watersheds and that these conditions can hardly be affected by the small amount of acidity (2-4 parts per million) that arrives in acid rain (even at 4 ppm--equivalent to a pH of 4.1--it would take 85 years to deposit an ounce of sulfuric acid on a square foot of soil). Similar rebuttals are made to the claims that acid rain is harming the forests, or agricultural crops or that its impact on human health or on erosion or corrosion of exposed material surfaces is significant in comparison with other processes.

Indeed the only major area in which a consensus exists is that reducing emissions which create aerosols would result in improved average atmospheric visibility, but even that has not been quantified. In fact, it is at least doubtful that the improved visibility would be noticed by many citizens even after the $100 billion is spent on reducing emissions.

5. In light of the available technical information, what can be done and what should be done about acid rain now, in the near future,and over the long term? That is, what might be the best policy at the federal level?

This is a very complicated issue especially in light of the extreme uncertainties in the scientific knowledge and because of what appears to be huge costs and conjectural benefits in the currently proposed legislative initiatives. As this issue is likely to remain active for years acid-rain policy probably will be reviewed frequently as policymakers attempt to respond rationally to the political pressures and to the best technical estimates of the cost-effectiveness of various mitigative measures. Our tentative recommendation to federal policymakers is as follows:

a. Expand the national acid-precipitation research effort over the next 5 years or more, up to $150 million per year, if necessary ($18.2 million dollars were spent by the federal government in 1982). It is important to get solid scientific information if the government is to formulate reasonable responses to the potential damage from acid precipitation and to avoid costly boondoggles.

b. Encourage the development of improved cost-effective technologies for reducing the emission of acid precursors and other pollutants from all sources, large and small. These technologies are likely to be needed in many new installations in any event, and would be desirable in a program which requires extensive retrofitting. In particular, new methods of removing sulfur from coal before it becomes a flue gas appear to be potentially very valuable over the long term. The federal cost of providing incentives to private industry for such a program might exceed $200 million per year over the next several years, but if properly formulated it should be an excellent long-term investment.

c. To the extent that liming of selected lakes and streams can be shown to be a desirable and cost-effective interim, if not long term, measure for creating a desirable ecological balance that approach should be pursued. A cost-sharing federal-state prototype program might be advisable over the next ten years. It is hardly likely that even a large effort involving 200 lakes would cost as much as $20 million/year in 1983 dollars.* If it is successful it could reduce one of the major current causes of political pressure to take hasty legislative action of a costly and potentially disruptive nature.

d. An experimental retrofit program involving $.5 to $1 billion/year for controlling acid-forming emissions from major sources nearest to the sensitive Adirondack area could be the first phase of a potential long-term program of retrofitting--it remains to be proven through research that a Phase-II would be desirable. The initial retrofitting would probably involve power plants and possibly other large industries in New York, Pennsylvania, New Jersey and possibly some New England states. That experimental program could be based upon the substitution of low-sulfur coal or natural gas for present high-sulfur coal or other sulfur-containing fuels. If it were based upon the use of scrubbers it would be more costly. These changes should be integrated into the acid deposition research program in a timely manner in order to test the predicted impact of those changes against the observed results.

e. The last (and still tentative) recommendation is that due consideration be given to a stronger policy of controlling the emission of acid-forming pollutants into the atmosphere from all new fuel-burning installations and vehicles. The heart of such a program would be the requirement for some stipulated level of control technology to be incorporated into each relevant change in the nation's capital stock. That is, every new engine, boiler, furnace, heater, cooking facility, etc., purchased or installed after, say, 1984 would have to meet a specified minimum performance level. As technology progresses over time that minimum level could gradually be made more stringent. In that way as the capital stock of the nation gradually rolls over, it will become increasingly effective in reducing all air pollutants, and the acid rain precursors in particular. With such an approach a great deal of progress in reducing all air pollution should occur steadily over the long term without the ugly prospect of compulsory, unfair, costly, and possibly ineffective retrofitting.

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*According to EPRI, lake-liming costs should average about $60 per acre. The 178 Adirondack lakes in critical condition have about 7,500 acres. Thus about $4.5 million would be required for each application if all of them were to be limed. Repeat applications may be required every three years or so. EPRI, EA-2362, Feasibility Study to Utilize Liming as a Technique to Mitigate Surface Water Acidification, April 1982.

6. What could affect public opinion and the political climate in which policy decisions will be made? Public opinion attitudes indicate that the pragmatic approach to problems, particularly domestic problems, remains the same as it has been since the 1930s. On environmental issues there is a broad-based consensus which cuts across all party lines, and includes all ethnic and regional groups. Although people remain concerned about the environment, they are currently much more concerned about economic issues and they expect a balance to be struck among efforts to preserve the environment, sustain economic growth, and create more jobs. The apparent "paradox" merely means they want prosperity without too great a cost to the environment and vice versa.

Currently the general attitude of the public, although reflecting a 20-year trend of more liberal thinking on issues of personal behavior, continues to be center or center-right politically. The public's values regarding family, community, schools, etc., remain basically the same. For example, an overwhelming majority are in the center to center-right on school busing, the death penalty, and banning hand guns.

Recent polls show that environmental considerations are near the bottom of the list of most important issues, or do not even appear on the list. Inflation, unemployment, crime and the conditions of the schools are all now more important than environmental issues. On the other hand, when asked directly, citizens will express a considerable concern for the environment and would prefer that more money be spent to protect it--even if it means higher taxes, utility bills, etc. In this context it is important to understand that probably over 100 million people use the "great outdoors" for recreation.

Specifically pertinent to the question of acid deposition, an estimated 45 million fresh water fishermen, and 12 million hunters, among others, would be disturbed if they believed that it would cause serious damage to the woods, streams or lakes--or even to the aquatic flies on which the fish feed. These people love the lakes, rivers and woods and spend considerable amounts of money to preserve them. They are "professional" environmentalists in this sense. Although basically low-profile people, they can become very active if they believe their favorite recreation is threatened. However, their activism is invariably within the traditional democratic process, and they vote often in both local and national elections.

The outdoors people are different from the relatively small group of single-issue environmental activists, who have been described as "public interest elites." These elites have been found to be atypically liberal or "cosmopolitan" in their standards. Almost 60 percent have family incomes in excess of $50,000 a year and 90 percent regard themselves as liberals. Their involvement with environmental issues leads them to give economic considerations a much lower priority.

Other groups of "activist" environmentalists, however, represent a much broader following. For example, the National Clean Air Coalition includes some organizations that have long been identified with environmental issues and others which previously have not. However, its position against acid rain is relatively extreme compared to those of the American Chemical Society or the American Association for the Advancement of Science.

Potentially, a great concentration of public opinion on legislation dealing with acid rain might stem from a coalition of some otherwise unlikely partners. That could occur if the National Clean Air Coalition joined with some fishermen's groups and generated enough publicity to get other outdoors recreational groups involved.

This analysis does not imply that the larger coalition or a political groundswell is imminent. As fishermen and hunters now have higher-priority concerns, their votes are driven largely by critical economic issues. On the other hand, in tight political races their views on the acid rain issue could determine the outcome, if they become convinced of the need for action.

VII. CONCLUSIONS

1. Past data on the amount of acid precipitation--which have indicated a trend of increasing acidity--have been shown to be erroneous for several reasons. Only the data after 1978 appear to be reliable and they suggest that the average amount of acidity in precipitation has been stable.

2. The variations in the acidity of precipitation at different sites from a single storm, or during the storm at any one site can be and frequently are very large. That implies that data about the amount of acid precipitation deposited in any area can be determined only with considerable difficulty and that claims about the amounts that are being deposited in any region are not reliable.

3. The dilemma facing the Congress is that the presently-proposed acid rain control legislation will have the following characteristics:

   a. After compliance with the legislation is complete it is not certain that any change in the measured amount of acid deposition in the sensitive eastern areas will be observable.

   b. If it is observed and found to be significant (e.g., a 20 percent decline) then it is not certain that any of the desired impacts on aquatic or forest ecosystems will be observed.

   c. The only certainty is that the economic and social costs will be large.

4. Natural sources of acidity exist which could account for most of the relatively few acidified aquatic systems. The principal sources are a) the naturally acidic soil of forest floor, especially where the underlying rocks are low in alkalinity and b) wetlands (bogs or marshes) which are adjacent to lakes, or through which streams flow on the way to lakes.

5. a. Land-use effects such as clear-cut lumbering tend to reduce soil acidity. More important the remaining litter becomes susceptible to forest fires which, if they occur, will leave a strong alkaline ash that could have a beneficial impact on aquatic ecosystems for decades.

   b. Other effects such as the massive growth of the northeastern forests since the 1930s (an estimated 70 percent increase) should lead to increased soil acidity, which in turn could stress the aquatic ecosystems in areas with little alkalinity. Could the effectiveness of the U.S. Forestry Service in protecting forests have been indirectly responsible for the loss of fish in some of the sensitive areas?

6. Many additional claims of damage to human health or to materials have been suggested--usually in a somewhat scattergun approach and generally without substantial evidence. Although we cannot assert that those claims will be found to be without substance the available evidence that has been gathered by the EPA tends to give those claims a lower priority in their investigations. At present they do not provide sound support for control legislation.

7. Although the estimated annual costs of a 10 MTPY reduction in SO_2 ranges from $3 billion to $12 billion our estimate of these costs is from $7 to $10 billion, or roughly $100 billion in present value terms.

8. The direct economic cost of control legislation would be the highest if most utilities are constrained to comply by installing scrubbers based on current technologies. Switching to low sulfur coal is less costly in direct economic terms but would be associated with severe local unemployment in the coal states and socio-economic ripple effects that would tend to preclude that option.

9. The impact of the control legislation on any existing plans of utilities and industries to switch from oil to coal is likely to mean an abandonment of those plans and an estimated increase of oil imports by about one million barrels per day. The costs of those additional imports plus the expected higher prices that they imply for all petroleum products would increase costs to oil consumers by about $18 billion per year--roughly twice as much as the direct economic cost of operating scrubbers. People in the Northeastern part of the U.S. would be most affected by these costs. In addition, and most importantly, the prolonged U.S. dependence upon foreign oil supplies would jeopardize the nation's security.

10. There are indications of an emerging scientific backlash that is contradicting the earlier claims that acid deposition is the cause of the observed damage to aquatic and forest systems. This backlash seems to be occurring in Europe and in the U.S. and may become pronounced during the next year or so.

11. From the perspective of the national interest the use of low-sulfur coal would be preferable to the installation of scrubbers. However because of the social and political impact on the states which have large high-sulfur coal

industries it seems more likely that the preferred response to control legislation would be the use of scrubbers.

12. To prevent passage of the proposed acid rain legislation those who would be affected by it must accept the burden of proving that they are not the culprits deserving such punishment. If they are only able to prove that contention after having complied with the law, they would have no recourse--unless the Congress stipulated in advance that it would be so liable. Could such an amendment to the legislation be tolerated by the Congress?

13. a. If the arguments are convincing that reducing SO_2 emissions will stop the degradation of lakes, forests and other environments by acid rain, considerable public support for such legislation would be forthcoming. Currently, the fate of the environment is low on the public's list of "most important issues." However, preserving the environment is given a relatively high priority by the average American when a specific issue is brought to his attention. Then he is willing to be taxed or to pay higher utility bills, if he believes that the expenditures will preserve the environment. But Americans also want economic growth, jobs, and a rising standard of living without a great impact on the environment. This is typical of their pragmatic approach to most issues, and of their belief that it is possible.

    b. A large and politically powerful opposition might result from an otherwise somewhat unlikely coalition--that of environmentalist groups such as the National Clean Air Coalition together with fishermen's and other sportsmen's organizations. Given enough convincing arguments (an important assumption), millions of these sportsmen could become worried enough about game fish and animals and their habitats to actively support control legislation. This is not to say that such a coalition is likely or that it would make acid rain a high-priority issue. Fishermen and hunters, like most Americans, now have other concerns of high priority. They are seldom single-issue voters and are driven much more by critical economic issues. On the other hand, "other things being equal," if they should lean toward the views of the National Clean Air Coalition on acid rain, this issue could sway enough of their votes to make a difference in tight political races.

Acid Rain on Acid Soil: A New Perspective

Edward C. Krug and Charles R. Frink

Summary. Acid rain is widely believed to be responsible for acidifying soil and water in areas of North America and northern Europe. However, factors commonly considered to make landscapes susceptible to acidification by acid rain are the same factors long known to strongly acidify soils through the natural processes of soil formation. Recovery from extreme and widespread careless land use has also occurred in regions undergoing acidification. There is evidence that acidification by acid rain is superimposed on long-term acidification induced by changes in land use and consequent vegetative succession. Thus, the interactions of acid rain, acid soil, and vegetation need to be carefully examined on a watershed basis in assessing benefits expected from proposed reductions in emissions of oxides of sulfur and nitrogen.

Acid rain is widely considered one of our most serious environmental problems. In landscapes where hydrology and geochemistry do not allow complete neutralization of acid runoff, acid rain is thought to be acidifying lakes and streams, as well as mobilizing aluminum and other metals toxic to fish and plants. Nutrients are also thought to be depleted by acid rain, raising concern about large areas of productive forests located on soils that are strongly acid and low in nutrients. A gradual acidification and sterilization of our soil and water, particularly in parts of the Adirondacks, northern New England, southeastern Canada, and southern Scandinavia, is predicted.

From its inception, however, soil formation in humid temperature climates is an acidifying process, mediated by the classic factors of geology, climate, biology, topography, and time. Indeed, the factors thought to make landscapes sensitive to acid rain are those that develop some of the most acid soils in the world. The results of natural soil formation are those attributed to acid rain: leaching of nutrients, release of aluminum, and acidification of soil and water.

Landscapes have usually been assumed to act merely as net sinks for acid rain (*1*), but generation of acidity in soils has recently been recognized as an additional source. This is evident in reports of the Norwegian project on "Acid Precipitation—Effects on Forests and Fish" (the SNSF project), for example (*2–4*). However, acid rain is still considered principally responsible for regional acidification (*2–4*), because the increased flux of SO_4^{2-} in rain is thought to result in equivalent leaching of hydrogen ions and other cations. We believe that this assessment needs reexamination. Large amounts of humic acids are present in forested landscapes thought to be particularly sensitive to acid rain. The solubility of these humic acids is controlled by *p*H, and hence they effectively regulate both acidity and anion flux.

In this article we define acidity in relation to rain and soil, describe how soil formation can acidify soil and water as well as leach nutrients and aluminum, show how humic acids buffer soils, and finally discuss the impact of changing land use and consequent vegetational succession. We wish to show that natural soil formation is often more important than acid rain in determining the acidity of lakes and streams.

Acidity of Rain and Soil

Rain in equilibrium with carbon dioxide in the air has a *p*H of about 5.6. Rain at *p*H 4.6 is often said to be ten times more acidic, but this neglects the acidity of undissociated carbonic acid (H_2CO_3) normally present in rain. The strong acid necessary to reduce the *p*H of rain from 5.6 to 4.6 actually represents a twofold rather than a tenfold increase in total acidity (*5*).

The acidity of rain has also been expressed in terms of the amount of limestone, $CaCO_3$, that can be neutralized or leached from the soil (*6*), but the amounts that can be dissolved by rain at *p*H 5.6 are often ignored. An annual rainfall of 1 meter per hectare at *p*H 5.6 can dissolve 400 to 500 kilograms of $CaCO_3$ per hectare, depending on the values of the thermodynamic constants used (*5*). Rain at *p*H 4.6 can dissolve an additional 10 to 1[illegible] ly acidified to *p*H 4 can dissolve an additional 50 kg/ha or about 1 kiloequivalent per hectare. For comparison, managed agricultural soils in the northeastern United States may require limestone additions of 50 to 100 keq/ha per annum.

Measurements of acid in soil are somewhat analogous to measurements of acid in rain. With clay minerals and organic macromolecules acting as immobile anion phases, soils resemble weak acids, making a thermodynamic interpretation of soil *p*H uncertain. However, certain principles apply: increasing concentrations of neutral salt decrease the measured *p*H, whereas increasing dilution with water increases *p*H. This salt effect is significant in measuring acidification of runoff.

The exchange acidity of soil is the analog of the total acidity of rain and is defined in terms of hydrogen ions readily exchanged by neutral salts. Acid humus typically has an exchange acidity of about 1 eq/kg, which is about 10,000 times greater than its acidity expressed as *p*H. In mineral soils, much exchange acidity is produced by hydrolysis of ionic aluminum. Hence, at *p*H values that are typical of strongly acid soils, ion exchange sites on minerals are occupied primarily by ionic aluminum and some additional aluminum is complexed by organic matter, giving a total exchange acidity on the order of 1000 keq/ha.

Soil Formation

The more mature a soil is the more it differs from its parent material, although the degree of difference is strongly influenced by geology. In humid temperate climates soils are more acid than their parent materials; water percolating through freshly ground granite is alkaline (*p*H 8 to 9), but soils developed from granite are acid. There is sufficient acidification that mature soils developed even on limestone or marble can be acid (*7*).

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[illegible] dec elements in parent materials produces acidity. It cannot account for the extremely acid podzols and related peats found on granite-like rocks. Acidification of these soils is biological (*8*); hence, the soils are most acid at the surface, where most decomposition and leaching occurs.

The major sources and sinks of soil acidity are illustrated in Fig. 1. Initially, weathering of freshly exposed siliceous bedrock is rapid and bases such as calcium, magnesium, potassium, and sodium are leached (pathway 3d in Fig. 1). Acid is generated by the biological oxidation of carbon, nitrogen, and sulfur, much as acid rain is created by the burning of fossil fuels. Because the partial pressure of CO_2 in soils can be 100 times that in the air, potential weathering rates by H_2CO_3 are immense, although seldom achieved in nature. Reaction and removal of hydrogen ions favor continued dissociation to H^+ and HCO_3^- (pathway 2c). With time, rates of acid neutralization, weathering, and cation denudation decrease and acids accumulate. Little H_2CO_3 is consumed by mineral weathering; most of it is lost as CO_2 and H_2O (pathway 2c). This is reflected by the low bicarbonate alkalinity of runoff from watersheds with strongly acid soils.

A layer of humus eventually forms which often lies over bleached mineral soil. Earthworms and other organisms that mix litter with mineral soil are now absent, and microbial populations have changed. Production of simple organic acids is slight, but production of partially oxidized humic acids of high molecular weight is favored (9). These humic acids more strongly acidify their environment than the final oxidation products of CO_2 and H_2O. The increased acidity decreases the solubility of humic acids (*10*), and enhances their accumulation. The rate of mineral weathering is now exceedingly low, most organic acids are lost as CO_2 and H_2O, and the upper mineral soil is a highly weathered siliceous residue resistant to acid weathering. This process is known as podzolization, and soils with distinctive bleached horizons are known as podzols.

It is often thought that acid humus accumulates because organic matter decomposes slowly. This is clearly true where thick peat develops under sparse vegetation. It is not true for the productive forests on podzolized acid soils in the Northeast, southeastern Canada, and Scandinavia (*11*), where concern about acid rain is greatest.

Formation of mature podzol soils from freshly exposed materials is measured in [illegible] and [illegible], because the [illegible]ity of the parent material to neutralize acid is great relative to rates of weathering. For example, the potential for neutralization of acids by the parent material at Hubbard Brook in New Hampshire is nearly 21,000 times greater than the yearly inputs of acid rain and 11,000 times greater than the estimated rate of mineral weathering (pathways 3a to 3d in Fig. 1) (*12*). In addition, the aluminum oxides in the parent material neutralize acid in water (pathway 3c) when the *p*H is below 5 and serve as an enormous sink against acidification (*13*).

Although some preferential flow occurs in soils, so that not all ion exchange sites can react equally with leachate, the time scale of weathering allows distinctive soil horizons to develop parallel to the earth's surface rather than surrounding vertical channels of preferential flow. Given the rate of soil formation, or even the 100 or more years said to be necessary for significant leaching of cations by acid rain (*14*), strong acidification of mineral soil is generally restricted to the upper soil profile. In addition, the earth's surface is not stable: erosion, tree throw, frost heaving, and soil creep constantly expose new and less weathered mineral material. Although the amounts of soil [illegible] are small, the [illegible] resistance to acidification is large. Only where weathering can keep pace with disturbance do we see mature, albeit heterogeneous, soil development.

Acidificatinn of Soil and Water

Because cation exchange reactions are rapid, hydrogen ions in acid rain could rapidly acidify soil by depleting exchangeable base nutrients. If increases in H^+ in acid rain (ΔH) leached nutrient cations (ΔM) from soils on a charge-equivalent basis (that is, $\Delta M/\Delta H = 1$), strongly acid soils would be highly susceptible to acidification because of their low nutrient content. However, the ability of hydrogen ions to remove nutrient cations from soils more acid than *p*H 5 is low; that is, $\Delta M/\Delta H \ll 1$ at the mean *p*H of present-day acid rain (*15*). Conversely, base nutrient cations are efficiently retained. Data on acid soils and acid rain in areas of concern around the world show that, on average, the proportion of bases to acid in the rain is usually equal to or greater than that in the strongly acid forest soils on which the rain falls (*15–17*).

Artificial leaching experiments, some

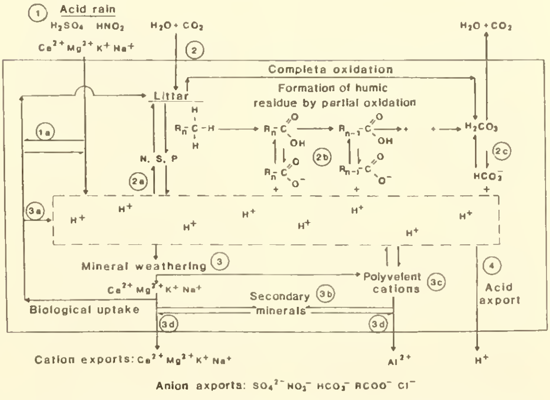

Fig. 1. Major sources and sinks of acidity in soil. Acid rain (1) is a source of acidity, but its composition may be altered before reaching the soil (1a). Although biological processes (2) are net sources of acidity, this obscures the fact that they serve as a substantial sink in acid soils through the production of weak organic acids (2b), which are ultimately converted to CO_2 and H_2O (2c). Mineral acids (2a) can be cycled rather tightly, with some sulfur and nitrogen lost to the atmosphere and some sulfur and phosphorus converted to solid phases. Weathering of minerals (3) generally consumes acid in excess of cation export (3d), as secondary minerals (3b) and hydrolysis products of aluminum, iron, and manganese (3c) accumulate in soil. Aggrading vegetation results in net cation uptake (3a) and can contribute to acidification. Rain which is less acid than the soil solution can also be acidified by hydrolysis (3c). Cation (3d) and acid (4) export is charge-balanced principally by anions shown at the bottom.

[illegible] verify that acid rain at pH 4 or higher is inefficient in replacing base cations from podzols and related acid soils (*2–4, 18*). As soil pH increases above 5, base cations are replaced more efficiently. Thus, the less acid soils with low cation exchange capacity developed on coarse siliceous materials are actually more susceptible to acidification (*15*). Little research has been conducted on the impact of acid rain on such soils (*19*).

Bicarbonate alkalinity is the principal measure of the ability of lakes to resist acidification. In highly siliceous watersheds with acid soils where rates of mineral weathering by H_2CO_3 are low, inputs of HCO_3^- per unit drainage area are also low. Lakes in such watersheds with small ratios of drainage area to lake area could be acidified by acid rain falling directly on them. Little change in pH will occur until 80 to 90 percent of the bicarbonate has been neutralized (*20*). One lake in Canada that occupies about 40 percent of an entire watershed has apparently been directly acidified by acid rain (*21*). However, this direct acidification is usually considered a minor factor relative to acid runoff (*2–4, 20, 22*).

Alpine-like lakes and streams in granitic terrain are believed to be especially vulnerable, particularly where there is little mineral soil and permeable geologic material to neutralize runoff from acid rain. Also, the relatively steep and short slopes of these landscapes minimize infiltration and time of contact with neutralizing minerals. The granitic shield and similar areas of eastern North America and northern Europe also have large proportions of extremely acid peats with only small amounts of weatherable minerals (*1, 20, 23–26*). Because these peats often border lakes and streams, they can exert a disproportionately large influence on water chemistry (*25, 26*). For example, acid peats cover 24 percent of a watershed in southernmost Norway, and 62 percent of the drainage flows through them (*26*).

The factors thought to make these landscapes sensitive to acid rain also limit neutralization of runoff acidified by acid soil. The thin and rocky soils that develop on these areas naturally produce such thick humus that they are often classified as organic soils (*17, 24, 27–31*), and they have a lower pH than the thicker soils downslope (*27, 31–33*). This topographic gradient in soil chemistry and other properties, where the upland soils are "leaky" and act as A horizons and the lower-lying sites act as B horizons, is known as a geochemical soil catena [illegible] acidity paralleling a soil catena in mountainous areas should not be surprising, although it is not always evident. Such gradients have been observed at Hubbard Brook and other mountainous watersheds in the northeastern United States, but the acidification has been attributed entirely to acid rain (*35, 36*).

The interim report of the SNSF project attributed acid runoff solely to acid rain (*1*). This evoked criticism from other Scandinavian scientists, who noted that the amounts of acid in soils are enormous relative to that in rain and that runoff from acid soils will be acid regardless of the pH of rain (*37, 38*). They suggested that in such watersheds, runoff from heavy rains and rapid snowmelts is acidified because a greater proportion is in contact with the most acid surface soil horizons. Thus, hydrologic factors can make rapid runoff significantly more acid than runoff from gentler rains or slower snowmelts, which percolate to a greater depth and more slowly through less acid subsoil and geologic materials. In short, the effects of acid rain were said to be confused with those of acid soil (*37, 38*).

A later report of the SNSF project acknowledged that soils can act as both sources and sinks for acid and that the effects of acid rain were not clearly expressed even in watersheds as small as 10 ha (*39*). Accordingly, "minicatchments" ranging in size from 0.003 to 0.026 ha were established. Because of their small size, shallow soil, and large areas of exposed bedrock (46 to 74 percent), these catchments represent a worst case where the effects of acid rain should be most evident (*39*).

On average, runoff in the minicatchments was twice as acid as the acid rain, and the pH of the runoff was correlated with soil pH. Only for the heaviest rains in the smaller basins was the pH of rain found to measurably affect the pH of runoff (*39*). There was essentially no difference in acidity between the snowmelt from a snowpack at pH 4.3 and that from a snowpack neutralized to about pH 7 (*40*). Artificial rain at pH 3.85 acidified runoff by 0.2 to 0.4 pH unit, but it was concluded that further studies were needed to determine whether such acid rain can measurably acidify runoff in larger watersheds (*41*).

Although it has been demonstrated that acid soils can acidify runoff, it is still contended that acid rain is the major factor in the acidification of leachate and runoff. We believe that this is due to a number of misconceptions. One of them concerns anion leaching. As we noted [illegible] hydrogen ions in acid rain at pH 4 or greater are inefficient in exchanging bases and thereby in acidifying strongly acid soils. Accordingly, most of the hydrogen ions in rain are thought to remain in solution and move through the soil accompanied by sulfate as the principal anion (*2–4, 20, 22, 42*). Sulfur in rain generally exceeds the nutrient requirements of forests, and humic materials coat aluminum and iron oxides that might otherwise immobilize sulfate by anion fixation (*1, 2–4, 20, 42, 43*). Thus, most of the H_2SO_4 falling on these soils is thought to move through them, causing increased cation leaching proportional to the increased flux of SO_4^{2-}. Similarly, acid peats are considered to offer little resistance to acidification of runoff by acid rain (*1, 2–4, 20, 26*).

However, the anion leaching theory has a major flaw. Watersheds considered to be most sensitive to acid rain have soils that are strongly acid and rich in humus, and their chemistry is not one of simple ion exchange. Humic materials act as weak acids; they dissolve in water and color and acidify it. The solubility of humic materials is a function of pH: the more acid the water, the less is dissolved (*10*). Sulfate apparently does not react strongly with humic materials, but the added H^+ in acid rain hinders their dissociation and decreases their solubility (*10*). The response is analogous to that of an inorganic system containing an excess of a sparingly soluble solid phase. Thus, additions of H_2SO_4 in rain should increase the flux of SO_4^{2-} and decrease the flux of organic anions with little or no measurable change in pH (*44*). Organic acids that accumulate are fated to be oxidized to CO_2 and H_2O.

Such a buffering mechanism helps explain why acid rain does not increase cation leaching in strongly acid soils at rates equivalent to deposition (*18, 45*). Rates of cation export from watersheds in the northeastern United States, Canada, and Norway which are thought to be sensitive to acid rain are remarkably low (*1, 35, 46–49*). Investigators at Hubbard Brook found it perplexing that the rate of cation export from the watershed was unusually low and apparently not enhanced by acid rain (*49*). Johnson (*35*) reported that "geologically, no excessive chemical weathering activity [as measured by cation export from watersheds] can be attributed to acid rain over the northeastern United States."

Other researchers state that the strong acids in acid rain result in equivalent leaching of cations (*1, 46–48*), but this conclusion is not supported by their own data. For example, rates of loss of cat-

[illegible] inputs of acid rain are highest (*47*). If the assumption of equivalent leaching were strictly applied to Norwegian data there should be no net loss of cations without acid rain, because net losses of cations are equivalent to inputs of acid in acid rain (*1, 48*).

The organic acid buffering mechanism also offers an alternative explanation of the observation that humic-colored lakes in Scandinavia are becoming clearer, an effect previously attributed to precipitation of humic acid by iron and aluminum dissolved by acid rain (*50*).

Leaching of Aluminum

The presence of aluminum ions in solution in soil and water at pH 5 or less has been considered evidence of dissolution of aluminum by acid rain (*1, 43, 51*). Even though it has long been known that large amounts of soluble aluminum are present in acid soils, the discovery of leaching of soil aluminum by acid rain (*43*) has been described as a principal and historic contribution (*52*). The discovery was based on the observation that there is considerably less aluminum mobilization in "pristine" sites in New Mexico and Washington than in "polluted" sites at Mount Moosilauke in New Hampshire. This is not surprising, however, since the soils in New Mexico and Washington are naturally less acid than those in New Hampshire (*53*).

There is a further misconception that aluminum leached from the A horizon of podzols is normally immobilized in the B horizon, and hence that aluminum in leachate which has moved through the B horizon must have been dissolved by acid rain. Such movement of aluminum out of soils is implicit in the concept of the geochemical soil catena (*34*). Some aluminum is leached and may appear in surface waters, as shown in 1930 by Joffe and later by others (*54, 55*). Indeed, at the sites in Washington examined by Ugolini and co-workers (*53*) one-third to one-half of the aluminum from the A horizon remains in solution in the B horizon. Aluminum does not appear in nearby spring water because it is precipitated as the water moves through fractured basic andesite bedrock. In New Hampshire, on the other hand, the water moves rapidly over solid bedrock, and hence aluminum appears in adjacent spring water.

The belief that aluminum ions in water result from acid rain is supported by the idea that all aluminum leached from organic-rich soils is complexed by organic [illegible] humic materials do complex most of the aluminum, as shown 50 years ago (*56*). However, aluminum complexation decreases dramatically as the pH decreases below about 4.5. Likewise, the solubility and mobility of complexed aluminum decrease as acidity increases (*10, 57*). Accordingly, ionized aluminum should be expected in water draining from organic-rich soils at pH 4 or less. This may also help explain why more aluminum is leached from the upper soil horizons at the Washington sites at pH 4.5 to 4.7 than at the New Hampshire site at pH 4 (*43, 53*).

Basic cations in rain may also promote exchange of ionized aluminum from acid soil into leachate and runoff. Indeed, the data from the snowmelt study mentioned earlier suggest that sodium in the neutralized snowpack replaced aluminum on exchange sites, which increased the concentration of aluminum in runoff for several weeks to about twice that in corresponding runoff from the snowpack with pH 4.3 (*40*). Acid rain may also increase the concentrations of base cations in forest throughfall. For example, about 90 percent of the hydrogen ions in acid rain at Hubbard Brook are neutralized in the northern hardwood canopy during the growing season; pH 4.1 rain becomes pH 5.0 throughfall (*58*). Although these leached nutrient cations are apparently taken up by the forest (*59*), the effects on aluminum chemistry are not known. Future studies should be carefully designed so that ion exchange by neutral salts (the salt effect) is not confused with dissolution of aluminum by acid (*60*).

Effects of Changing Land Use

Both regional acid rain and drastic changes in land use are associated with societal and technological evolution. Earlier, the exploitation of temperate forests was widespread and highly destructive. The remaining forests of western Europe all show the influence of man (*61*). The extensive heaths of Great Britain, Scandinavia, and northern Europe are the consequences of earlier and careless land use (*62*). Several thousand years of burning, grazing, and cutting caused severe erosion, which helped to create the unusually thin soils and low treelines of the uplands and low mountains of southern Norway (*2, 38, 63*). Many of these practices were transported to eastern North America with the arrival of the Europeans more than three centuries ago.

Fortunately, the temperate forests in [illegible] America [illegible] ciently resilient that they are now recovering. In New England, the volume of standing wood has increased by about 70 percent between 1952 and 1976 (*64*). Worldwide temperate forest regrowth is so great that it may influence the global carbon cycle (*62, 65*). Given the effects of vegetation on soil acidification, there is little doubt that recovery of landscapes from earlier disturbance can result in increasingly acid surface soil horizons and thickening and acidification of forest floors.

In the 1920's, Salisbury (*32*) demonstrated that successional change and forest recovery from previous exploitation were responsible for widespread acidification of British landscapes; the upper slopes, with their acidophilic vegetation, were shown to be undergoing the greatest acidification. Large-scale recovery of forests in New England stimulated early studies in Connecticut. Red pine planted in 1900 on abandoned corn and tobacco fields developed a forest floor with a pH of about 3.8 (*66*). Other plots were established in 1926 and 1927 in 20- to 40-year-old hardwood stands and have been protected from cutting and burning. Our measurements show that today hardwoods have acidified the forest floor at one site from about pH 5.5 to 3.9 and the underlying mineral soil from pH 5.1 to 4.6 (*67*). At another site there was almost complete mortality of oak from drought and defoliation. Basal area declined from 30.5 m^2/ha in 1957 to 4.6 m^2/ha in 1977. Here, we found that the pH of the forest floor had actually increased from 3.8 to 4.2 (*67*).

While soil properties and effects of changing land use vary from site to site and are even heterogeneous within sites, some general relations are evident. Land use and forest management studies in North America and northern Europe reveal that disturbance under conifers affects acidity and depth of humus more than similar disturbance under hardwoods (*28, 29, 54, 68, 69*). Likewise, the greater the disturbance, the greater the effect. Mixed hardwood-conifer forests are intermediate, but their response to disturbance tends to resemble that of conifers (*28, 29, 54, 68–70*). Thus, as Salisbury (*32*) concluded, recovery from earlier disturbance will have its greatest effects on the upper slopes—that is, on strongly acid soils rich in organic matter.

In the northeastern United States, the most severe changes have occurred in the spruce-fir forests of northern New England and on the steep slopes of the Adirondacks, where acid rain is thought

1900's essentially all the spruce-fir forests had been clear-cut for pulp, except for a small fraction of the forest in the Adirondacks which was preserved (*30, 71–73*). The original spruce-fir forests were very resistant to fire (*72, 74*), but lumbering was often followed by severe fires that largely or completely destroyed the thick forest floor (*28–30, 73, 75*).

The more intense a forest fire, the greater the effects on depth and acidity of the forest floor. Organic acids are oxidized and lost to the atmosphere, leaving alkaline ash on the soil (*28, 29, 54, 68, 69*). In managed spruce forests in Scandinavia, where controlled burning reduced the depth of humus by only 1 cm, the *p*H of the remaining 4 cm of humus rose 2 to 3 units. After 50 years the original depth of humus was restored, as was the original *p*H of 4. The *p*H of the upper mineral soil was still elevated by about 0.2 *p*H unit (*69, 76*).

The depth of the forest floor under undisturbed stands of spruce and fir on the upper slopes of the Adirondack, White, and Laurentian mountains commonly exceeds 30 cm and the *p*H is less than 3.5 (*27–31*). Diebold (*28*) showed that in the Adirondacks, fire in spruce-fir slope forests is more destructive to the forest floor than in other forest types (*28, 29, 68, 69, 75*). On the average, the depth of the forest floor up to 30 years after burning was reduced by 30 cm. The thinner and less acid forest floors of the lower slopes and valleys were reduced by 5 to 13 cm (*27–31*).

On the steeper slopes of the White Mountains the depth of the forest floor ranges from discontinuous to 5 to 10 cm (*77*), suggesting widespread destruction of the original forest floor. The depth of the forest floor may also be reduced in the absence of fire; in cutover but unburned Adirondack spruce forests the floor averages about 5 cm in depth (*78*).

The effect of cutting and burning on the *p*H of the forest floor on the steep slopes of the Adirondacks has apparently not been determined. In the various forest types of the lower slopes and valleys, Young [in (*68*)] showed reductions in the depth of the forest floor from both cutting and burning that were similar to those reported by Diebold (*28*). The *p*H of the forest floor averaged about 4 in undisturbed stands, but under stands that were cut or burned the average *p*H was about 5 when measured 20 to 50 years after disturbance. The *p*H of the mineral soil averaged about 0.7 unit higher under disturbed stands.

Maturation of forests also influences hydrology. As the depth of humus in-

into the subsoil may decrease (*79*). Runoff can become more acid not only because of the increasingly acid humus, but also because of the increasing proportion of near-surface runoff. Also, snowpacks last longer under older forests, making episodic flushes more likely during periods of warm weather or rainfall (*80*). The devastating effects of spring snowmelt may be more severe in part because of changes in hydrology and chemistry induced by changes in the forest.

Although the effects of forest disturbance and recovery are variable, it is apparent that recovery results in increasingly acid soil horizons and thickening organic horizons (*28, 29, 54, 68, 69*). Accordingly, water moving through such soil should also become more acid, and the proportion of ionized aluminum to organically complexed aluminum may also increase (*57*).

Thus, mountainous areas of the northeastern United States are not pristine environments that are acted on only by acid rain. These landscapes, which were disturbed in the past, are undergoing the soil formation process that produce the greatest increases in natural soil acidity.

The idea that changing land use and consequent vegetational succession are largely responsible for acidification of soil and water in southern Norway was first advanced by Rosenqvist (*38*). Forest recovery in southernmost Norway has been dramatic: the volume of standing wood increased by more than 70 percent during the period 1927–1928 to 1964–1973. Rosenqvist proposed that this large-scale recovery of forest and the reversion of land to acid heath and forest was producing large areas of increasingly acid soils. As an illustration, he showed that the exchange acidity of surface humus under a 90-year-old spruce forest on an abandoned Norwegian farm was equivalent to the strong acids in about 1000 years of rain of 1 m per year with *p*H 4.3. He proposed that these increasing amounts of increasingly acid humus and mineral soil (*81*) are acidifying runoff in watersheds where there is incomplete neutralization of acids by mineral weathering (*38, 63*).

The final report of the SNSF project acknowledges that changes in land use and consequent vegetative succession have long been known to acidify soil and will in general affect the alkalinity and *p*H of rivers and lakes (*2–4*). Nevertheless, it considers changes in land use to be a minor factor and concludes that the observed increases in sulfate in runoff and presumed equivalent increases in leaching of hydrogen, aluminum, and

the observed increases in acidity (*2–4*).

We believe that the effects of changing land use and vegetative succession cannot be dismissed on the basis of studies performed to date. Further, the hypothesis that increased deposition of acid and sulfate is causing equivalent leaching and acidification is theoretically unsound and is not supported by direct observations. Natural processes of acidification must be more carefully considered in assessing benefits expected from proposed reductions in emissions of oxides of sulfur and nitrogen.

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Mr. OTTINGER. Thank you.

I think we will hear next from Dr. Oppenheimer. In asserting your own testimony, I wish you would address yourself to some of the reservations expressed by the last two witnesses.

STATEMENT OF DR. MICHAEL OPPENHEIMER

Dr. OPPENHEIMER. Surely. Let me just note for the record that I am currently a member of the ad hoc committee to review the national acid precipitation assessment plan, operating through the Science Advisory Board, and I also am on the acid rain scientific advisory panel to the New York State DEC set up by Commissioner Williams.

I have been asked to testify before this subcommittee on behalf of a group of New York State citizens' organizations, a list of which is appended to my testimony. Fifteen separate statements from the organizations supporting H.R. 3400 with the addition of the 12 million ton amendment have been submitted separately to the record.

We fully support the efforts of Representatives Waxman and Sikorski to amend the Clean Air Act to control the emissions of sulfur dioxide and oxides of nitrogen, and it is truly gratifying that the political leaders of the State of New York, particularly the Governor, Mr. Abrams and Mr. Dunne and others have come here today to express not only full support for H.R. 3400, but to ask for its strengthening. Such unanimity is unusual, considering that New York State would be affected significantly in terms of required emissions reduction, and we in the environmental community are happy to see the recognition of this problem by our political leaders.

Acid rain is a national problem which calls for a national solution. It calls for a program which should be focussed primarily on sulfur dioxide emissions, but should ask for additional control on oxides of nitrogen. Therefore, we support H.R. 3400.

We also believe that H.R. 3400 should be strengthened in order to achieve a 12 million ton reduction in sulfur dioxide emissions to give the full measure of protection to sensitive aquatic resources. Acid rain programs involving significantly smaller emissions reductions than 10 to 12 million tons are totally inadequate to deal with the broad scope of the threatened or damaged resources.

Since a consensus has emerged on the major scientific issues, I shall not discuss them further, except to dispense with some of the arguments presented here a minute ago by the Power Pool and by Dr. Brown. I just want to note for the record that these issues have been gone over again and again by various Government advisory boards and committees that do not have any particular bias, and I will mention them just to remind everyone.

There is a critical assessment document put out by the Environmental Protection Agency; the two reports in 1981 and 1983 by the National Academy of Sciences; the 1982 draft report of the Office of Technology Assessment of the U.S. Congress; the reports of the working groups under the United States-Canada Memorandum of Intent on Transboundary Air Pollution; and the report of the experts at the Stockholm Conference on the Environment in 1982. They all conclude that acid rain is caused by industrial pollutants.

That it is causing the acidification of clear water lakes in many areas. And that the reduction of sulfur dioxide emissions is a major step that could be taken to solve the problem.

I will note also for the record, that the reduction in sulfur dioxide emissions over the last 15 years in New York State and elsewhere appears to have been accompanied by a significant reduction in sulfur deposition in New York State and other parts of the Northeast; and that the so-called natural soil acidity source explanation for the acidification of lakes, not only is at variance with the conclusions of the reports just mentioned, but is totally incapable of explaining the amount of sulfuric acid found in the acidified clear water lakes. There is undoubtedly acid from the soil, but the soil acts not like a filter but more like a strainer, with the water going through it not reaching acid equilibrium with the soils.

It suffices to note that acidified clear water lakes generally occur only where acid rain has fallen and not elsewhere—in the absence of runoff from mines.

Now let me put the science aside and focus on New York State. No State suffers more greviously from acid rain than New York. Acid rain falls across the entire State at levels which are sufficient to acidify sensitive lakes and streams. The existence of sensitive watersheds outside of the Adirondacks has been mentioned by Bob Boyle and I will not discuss it any further. Furthermore, the damage to other resources, besides aquatic resources, has also been mentioned today, and it is discussed in my prefiled testimony. I need not discuss the details.

I would like to mention, however, that there is a new threat from acid rain, the data for which has only recently been uncovered. Regrettably large segments of the New York City water supply system rest on geological formations which are sensitive to acid rain. We now have data in hand from the city and the State which demonstrates that the Catskill-Delaware water supply reservoir system in New York City is low in annual average alkalinity and may be considered to be extremely sensitive to acid deposition.

Some head water streams in this watershed are at least seasonally acidified. In other words, acidified waters feed into this city's reservoirs. The possibility of long-term acidification and toxic metal leaching in these sensitive areas is of great concern, since this water supply system serves over 7 million people and it is a priceless resource. Water treatments for these problems would be either ineffective or extremely costly.

This water supply system is now receiving acid rain at a level which has caused acidification to occur in sensitive lakes elsewhere. It is intolerable that this threat to the health of New Yorkers should be allowed to continue.

Where does New York State's acid rain problem originate? Every analysis in the published literature suggests that 70 to 90 percent originates outside New York State, largely in the coal-burning electric powerplants of the Ohio basin States.

Since sulfur deposition levels in New York are at least double that which sensitive lakes and streams can tolerate, New York's acid rain problems cannot be solved without large sulfur dioxide emission reductions in other States. What can be done to reduce New York State's acid rain problem? The soundest approach would be to define a loading level of 18 kilograms per hectare year, which is the level below which acidification is not observed in any areas.

An analysis performed by the Office of Technology Assessment indicates that the emissions reductions embodied in H.R. 3400 will come very close to achieving the target loading levels in all areas of New York State as well as all the other States in the East. With the additional 2 million ton reduction, attainment of target loading everywhere in New York can be assured.

Since a broad program of the type embodied in H.R. 3400 places significant emissions reduction responsibilities on many States, some of which have shown no interest in sulfur emissions reductions, it is reasonable to ask if New York intends to do all it can to reduce its own emissions.

At the outset, it should be noted that New York is a substantial sulfur emitter with nearly 1 million tons emitted in 1980.

Mr. OTTINGER. May I ask you to sum up?

Dr. OPPENHEIMER. I will. I want to note for the record the recent action of New York DEC in requiring flue gas desulfurization on Con Ed proposed conversions as the first major step toward sulfur control in New York State for the purpose of abating acid rain.

I would note that the groups for which I am testifying have further asked in the context of the DEC sulfur proceeding, that New York reduce its emissions by 50 percent and we are confident that those proceedings will move along in that direction.

Now, what will be the benefits of H.R. 3400? Sulfur dioxide emissions would be decreased by 200,000 to 250,000 tons in New York. Sulfur deposition would be decreased on the order of 50 percent. Electric utility rates would increase only on the order of 2 percent.

The environmental benefits brought by these changes would be large. Lakes and streams in almost all areas of the State would be protected. Acidified lakes and streams may begin to return to a healthier chemical state, at least partially.

Mr. OTTINGER. I think I had better cut you off.

Dr. OPPENHEIMER. Fine.

[Testimony resumes on p. 141.]

[Dr. Oppenheimer's prepared statement follows:]

ENVIRONMENTAL DEFENSE FUND

TESTIMONY OF DR. MICHAEL OPPENHEIMER
Before The
SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT
December 1, 1983

My name is Dr. Michael Oppenheimer. I am an atmospheric physicist and the senior scientist in the New York office of the Environmental Defense Fund. I am currently a member of the Ad Hoc committee to review the National Acid Precipitation Assessment Plan, operating through E.P.A.'s Science Advisory Board. I have also been asked to serve on an acid rain advisory panel to N.Y. State Department of Environmental Conservation Commissioner Williams.

My efforts in the last three years have focused on scientific research on the causes and effects of acid rain and on the analysis of emissions reductions strategies with particular emphasis on New York State. I have been asked to testify before this Subcommittee on behalf of a group of New York State citizens organizations* on the issue of acid rain.

We fully support the efforts of Representatives Waxman and Sikorski to amend the Clean Air Act to control the

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* Environmental Defense Fund, Environmental Planning Lobby, Scenic Hudson, Audubon Society (30 NY State chapters), Sierra Club (Atlantic chapter and 11 regional NY state groups), NYC and L.I. Friends of Clearwater, Council of Park Friends, Inc., Friends of the Earth (NY)

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emissions of sulfur dioxide and oxides of nitrogen which cause acid rain.

Acid rain is a national problem which calls for a national emissions reduction program. Such a program should focus primarily on sulfur dioxide emissions reductions but provide also for additional controls on emissions of oxides of nitrogen. Therefore, we support HR 3400. We also believe that HR 3400 should be strengthened in order to achieve a 12-million ton reduction in sulfur dioxide emissions, to give the full measure of protection to sensitive aquatic resources. Acid rain programs involving significantly smaller emissions reductions than 10 - 12 million tons are totally inadequate to deal with the broad scope of threatened or damaged resources. An analysis of the scientific basis for emissions reduction strategies ("Reducing Acid Rain"), demonstrating the need for the type of emissions reduction program embodied in HR 3400, is appended to my testimony. Since a concensus has emerged on the major scientific issues, I shall not discuss them further today. Allow me to focus on acid rain as it pertains to New York State.

No state suffers more grieviously from the blight of acid rain than New York. Acid rain falls across the entire state at levels which are sufficient to cause acidification of lakes and streams. From the western Adirondacks and the Lake Ontario region, where sulfate deposition exceeds 40 kg/hectare/yr, to the Southeastern part of the state, where deposition is about 30 kg/hectare-yr, to the Northeastern region, where deposition is in the mid-twenties, sulfate is pouring down at a rate which far exceeds the 17 kg/hectare-yr considered "safe".[1/] As a result, over 200 Adirondack lakes are devoid of fish life due to acidification. About 25 percent of Adirondack ponds are exhibiting the progressive effects of acidification and may be considered endangered.[2/] But the threat to aquatic resources is not restricted to the Adirondacks. Watersheds which are geologically sensitive to acid rain are widespread in the Southeastern part of the state, including parts of the Shawangunk Mountains, the Catskill Mountains and the Hudson Highlands (see Figure 1). These mountains are a priceless recreational resource for the New York metropolitan area. The Hudson Highlands watersheds, for instance, lie only 40 miles north of Manhattan. In that area, two surveys of lakes and ponds indicated that 25% of lakes were very sensitive to acid deposition and two were already acidified.[3/]

Furthermore, ecological damage due to acid rain is not restricted to aquatic resources. Both scientific and anecdotal reports indicate dieback of red spruce and other forest species in the Adirondacks and elsewhere in the state, with acid deposition implicated as an important stress factor. The absence of nutrifying soil bacteria was also noted in one area.[4/]

The effect of acid deposition on drinking water supplies is also a matter of extreme concern in New York State.

Several Adirondack supplies exhibit the effects of acidification including the presence of undesirable concentrations of metals. Regretably, large segments of the New York City water supply system rest on geological areas which are sensitive to acid rain. We now have data which demonstrates that the Catskill-Delaware system is low in annual average alkalinity and may be considered to be extremely sensitive to acid deposition. Some headwater streams in this watershed are at least seasonally acidified. The possibility of long term acidification and toxic metal leaching in these sensitive areas is of great concern since this water supply system, serving over 7 million people, is a priceless resource.

Other effects of acid rain from which New York is suffering include slow, incidious and costly corrosion of our infrastructure and buildings. Stalactites hanging from highway and subway overpasses are only one symptom of this problem.

Human health may be imperiled by inhalation of acid droplets and sulfur dioxide which cause acid rain. Finally, segments of our agricultural economy may be vulnerable to the type of damage which has been observed for some crops. All in all, this state suffers the full panoply of acid rain damage.

Where does New York's acid rain problem originate? Every published scientific analysis indicates that between 70 and 90 percent of the sulfur in rainfall falling in New York originates out of state, largely in the coal burning electric power plants of the Ohio Basin states.[5] The influx of sulfates from the Midwest has been established by observations of long range sulfur transport as well as by atmospheric models.[6] Since sulfur deposition levels in New York are at least double that which sensitive lakes and streams can tolerate, New York's acid rain problem cannot be solved without large sulfur dioxide emissions reductions in other states.

What can be done to reduce acid rain in New York? The soundest approach to defining an acid rain strategy is to aim to reduce emissions sufficiently that sulfur deposition falls below the target loading level of 17 hg/hectare yr. An analysis performed for the Congressional Office of Technology Assessment indicates that the emissions reductions embodied in HR 3400 will come very close to achieving the target loading level in all areas of New York State as well as in all other states.[7] With an additional 2-million ton reduction, attainment of target loadings everywhere in New York State is predicted.

Since a broad program of the type embodied in HR 3400 places significant emissions reduction responsibilities on many states, some of which have shown little interest in problems caused by their sulfur emissions, it is reasonable to ask if New York intends to do all it can to reduce its own emissions. At the outset, we should note that New York

State is a moderate source of sulfur dioxide, emitting about 940,000 tons in 1980. However, nine states in the eastern U.S., all with lower populations, emitted more sulfur dioxide than New York in 1980. Ohio emitted nearly three times as much sulfur dioxide. New York's emissions amounted to only four percent of the eastern U.S. total. Electric utility power plants in New York emit at an average rate of 1.4 lb/MBTU compared to 3-4 lb/MBTU in the Midwest. Yet, New York state is the only state to enforce any significant regulatory requirement related specifically to acid rain. In a landmark decision this September, NYDEC Commissioner Williams ruled that Con Edison must install flue gas desulfurization equipment on 2 power plants converted from oil to coal burning in order to prevent significant sulfur emissions, and acid rain increases. This decision could represent forgone present worth net savings of over $1 billion to New York ratepayers. In essence New York has committed itself to at least that much money in acid rain controls. No other comparable acid rain action has occurred anywhere.

Can New York do more to control acid rain? The answer is certainly yes. While the lion's share of acid rain falling in New York originates elsewhere, New York still contributes about as much to its own acid rain problem as any other single state. It also contributes to downwind acid rain in New England. In recognition of this fact, the NYDEC has established a proceeding to formulate a N.Y. state sulfur policy aimed at reducing sulfur dioxide emissions. EDF and other citizens organizations have called for a 50% reduction in all New York State sulfur dioxide emissions, in the context of this sulfur policy, by the middle of the next decade. We trust that the proceedings will evolve in that direction.

Through the Con Ed decision and the opening of the sulfur proceeding, New York has signaled an intention to get its own house in order with regard to acid rain. Therefore, the time is long overdue for other states to move toward large sulfur dioxide emissions reductions. HR 3400 provides a mechanism for accomplishing this end.

What effect would HR 3400 or an analogous 12-million ton bill have on New York? Sulfur dioxide emissions would be decreased by 200,000-250,000 tons. Atmospheric model analyses suggest that sulfur deposition would be decreased by about 45-50%. Electric utility rates would increase by only about 2 percent.

The environmental benefits brought by these changes would be large indeed. Lakes and streams in almost all areas of the state would no longer receive sulfur deposition above the target loading level at which acidification has been observed to occur. Acidified lakes and streams may begin to return to healthier chemical states, at least partially recovering, while unacidified lakes will be largely protected. Airborne sulfate aerosol concentrations will be cut in half on average, reducing significantly the impact of these particles on human health. The gradual insidious damage which is suspected to occur to our forests and soils will be slowed or eliminated. A major threat to the future of our drinking water supplies will be reduced. Needless to say, similar benefits will occur in other states but New York, the biggest loser to acid rain, stands to gain the most from acid rain controls.

New York State has indicated a willingness to move to large scale sulfur dioxide emissions reductions. But even the severest sulfur control program in New York alone cannot save its resources. A national program is needed, for the sake of both New York State and other areas affected by acid rain. HR 3400 calls for significant reductions by New York, but matches this demand with even larger reductions elsewhere. The mechanisms devised in this legislation for mitigating the costs of emissions reductions in some states cause only a small additional burden for New York. On balance, this state will benefit greatly by the proposed legislation.

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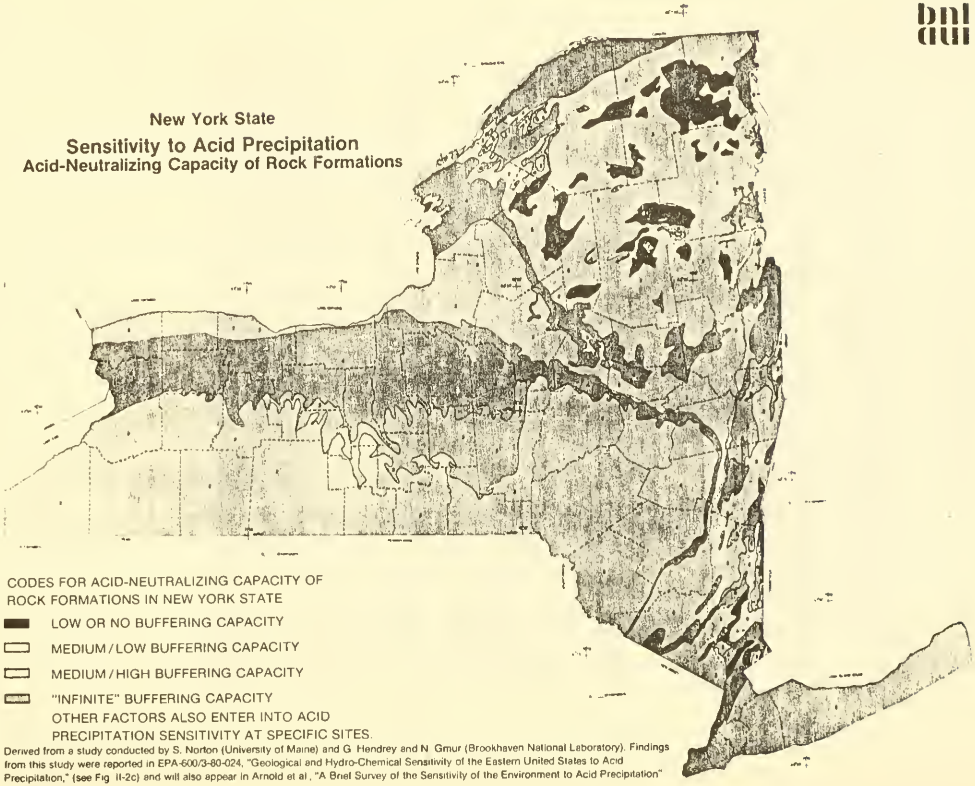
Figure 1

New York State

Sensitivity to Acid Precipitation

Acid-Neutralizing Capacity of Rock Formations



CODES FOR ACID-NEUTRALIZING CAPACITY OF ROCK FORMATIONS IN NEW YORK STATE

- ■ LOW OR NO BUFFERING CAPACITY
- □ MEDIUM / LOW BUFFERING CAPACITY
- □ MEDIUM / HIGH BUFFERING CAPACITY
- ▨ "INFINITE" BUFFERING CAPACITY

OTHER FACTORS ALSO ENTER INTO ACID PRECIPITATION SENSITIVITY AT SPECIFIC SITES.

Derived from a study conducted by S. Norton (University of Maine) and G. Hendrey and N. Gmur (Brookhaven National Laboratory). Findings from this study were reported in EPA-600/3-80-024, "Geological and Hydro-Chemical Sensitivity of the Eastern United States to Acid Precipitation," (see Fig. II-2c) and will also appear in Arnold et al., "A Brief Survey of the Sensitivity of the Environment to Acid Precipitation" (in preparation).

ENVIRONMENTAL DEFENSE FUND

REDUCING ACID RAIN

1. Introduction

Scientific understanding of acid rain dictates several general principles which should form the basis of control strategies. Among these are the importance of focusing primarily on sulfur deposition reductions, the need to obtain at least a 50% reduction in sulfur deposition, the relative effectiveness of sulfur dioxide, nitrogen oxide, and oxidant controls, the importance of controlling large sulfur emissions sources in the Midwest, and the importance of swift control action. In this paper, we shall briefly describe the evidence for these principles and their implications for a control strategy.

2. General Description of Acid Rain

Rainfall in the eastern United States is 10-40 times more acidic than normal on an annual basis. This acidity is due almost entirely to industrial and mobile source emissions of oxides of sulfur and nitrogen. Natural sources contribute only a small amount of sulfur and nitrogen to the atmosphere. In the eastern U.S., these natural sources are generally estimated at less than 5 percent of the total. Sulfur dioxide emissions in the 31-state eastern U.S. amounted to 22.5 million tons in 1980 of which 16 million tons or 71% came from electric power plants, mostly coal-fired. Nitrogen oxide emissions amounted to 14 million tons of which mobile sources contributed more than 40% and electric utilities about 30%.[1] Sulfur and nitrogen may fall to earth as the original sulfur dioxide and

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nitrogen oxides or may be converted to acids by chemical reactions in the atmosphere. These acids may fall to earth in precipitation (acid rain) or as acid droplets and vapors during dry periods. Almost all sulfur and nitrogen oxides which fall to earth in any of these forms become acid in our watersheds, forests and soils. Therefore, total deposition, wet and dry, is the best measure of ecosystem impacts. Because each sulfur molecule contributes twice as much acid as each nitrogen molecule, 2/3-3/4 of the total acid falling on land originates in sulfur emissions.

Due to shifts in fuel consumption patterns, sulfur emissions and measured sulfur deposition have decreased slowly in the Northeast over the last two decades, but increased in the southern and border states. Some Midwest states have shown increases and others decreases. Nitrogen emissions and deposition have generally increased. Sulfur deposition remains well above levels which are considered "safe" for aquatic systems (see Section 4.), even in states with emissions decreases.

The effects of these acids on our environment have been amply documented. Over the last 30 years or so, watersheds in about a dozen areas of Eastern North America have been acidified. The effects related to watershed acidification are

i. leaching of toxic metals into surface waters and perhaps groundwaters, including drinking water supplies;

ii. destruction of a wide variety of fish populations as well as other aquatic plants and animals due to the combined effects of acid and toxic metals;

iii. leaching of nutrients from soils and their removal from the watershed;

iv. possible destruction of fungi and bacteria which figure in nutrient and transpiration cycles;

v. probable stress on forests yielding reduced rates of growth of trees and other species

Effects not related to watersheds include

i. reductions in crop yields;

ii. accelerated corrosion of structural materials;

iii. probable aggravation of human respiratory and cardiovascular problems due to enhanced concentrations of airborne acidic pollutants and precursors.

Watershed effects related to surface water acidification have been intensively studied, and thus provide a quantitative basis for control strategies. Among the patterns now emerging is a widespread decrease in pH and alkalinities (acid neutralizing capacity) in buffered but sensitive surface waters at many locations in the East over the last two or three decades.2/

3. Control of Sulfur or Nitrogen?

Since sulfur is responsible for 2/3-3/4 of the acid entering our ecosystems, it is an obvious primary choice for control. Furthermore, on an annual average basis, sulfur is almost entirely responsible for increased acidity and decreased alkalinity in Eastern surface waters because, over the course of a year, almost all nitrogen added to watersheds is taken up in biological activity (as a "fertilizer") with the accompanying removal of its associated acid.[3] The different response of watersheds to sulfur and nitrogen is illustrated in Figure 1, which compares the sulfur and nitrogen input to watersheds from the atmosphere (in wet deposition) with the output from the watersheds' lakes. This figure is drawn from a watershed data base characteristic of the Northeastern U.S. and Southeast Canada. Note that very little nitrogen (10-30%) leaves a watershed compared to the amount which enters in wet deposition. When the dry deposition input is also taken into account, it is obvious that a very small fraction of nitrogen entering watersheds actually ends up in the lakes. In contrast, more sulfur leaves waters than enters as wet deposition with the discrepancy largely accounted for by dry deposition. So biological processes at work in watersheds can absorb nitrogen compounds and prevent them from entering lakes, but the same processes do not affect sulfur compounds, which pass directly into the water bodies. For watersheds in the Southeast, the soils tend to absorb sulfur, so that only about half the atmospherically deposited sulfur enters the waterbodies. In either case, sulfur far outweighs nitrogen in its contribution to long-term acidification.

In spite of its relative unimportance in long-term acidification, nitrogen concentrations in lakewater can increase markedly during spring snowmelt since biological uptake is minimal, meltwater is not easily neutralized by contact with the frozen ground, and nitrogen concentrations may be relatively high compared to sulfur in snowpack. At some locations in the Northeast, and in high mountain areas of the West, episodic acidification may continue to occur even if sulfur deposition is reduced. However, the reduction of sulfur deposition will ameliorate this episodic acidification to some degree everywhere, and the long-term biological significance of these episodes is unclear since large springtime fish kills on the scale of those reported in Europe have not occurred in North America. In any event, the significance of nitrogen in the spring snow melt observed in some Adirondack and New England watersheds may be an anomaly, atypical of much of Eastern North America.[4/]

Another factor which must be weighed in determining the relative importance of sulfur and nitrogen in ecosystem acidification is the role of oxidants in determining sulfur deposition rates. The concentration of oxidants in the atmosphere will determine whether reductions in sulfur emissions lead to proportional reductions in sulfur deposition (the so-called linearity issue); and the oxidant level is tied to the concentration of nitrogen oxides and hydrocarbons. The 1983 National Academy of Science[5/] report and other scientific research indicate that oxidants are available in sufficient quantities to permit a linear transformation of sulfur dioxide to acid rain. Therefore, reductions in emissions of sulfur dioxide from any source will yield proportional reductions in the sulfur deposited in the Northeastern U.S. from that source. If all significant sources were reduced by half, sulfur deposition at almost all receptors will be reduced by half. Furthermore, if emissions of nitrogen oxides and ammonia do not change, a given sulfur dioxide reduction will yield at least as great a decrease in precipitation acidity. A 50 percent sulfur dioxide reduction will yield an increase of 0.3 or more in precipitation pH. Only decreases in SO_2 emissions, not decreases in NO_x or hydrocarbon emissions, will produce proportional decreases in total sulfur deposition.

In summary, for watershed effects in the East involving surface waters, soils and possibly trees, sulfur deposition is the major source of longterm problems associated with acidification, although the episodic effects related to nitrogen may have longterm biological significance at some locations. Therefore, the first priority for control of watershed acidification is control of sulfur deposition. The most effective means to control sulfur deposition is to reduce sulfur dioxide emissions. Such controls will also produce larger benefits than will NO_x control for non-watershed effects such as crop damage and tree-leaf damage, and will also ameliorate materials damage. In total, sulfur dioxide control produces the greatest ecosystem benefits per ton removed. Although emissions reduction efforts should focus primarily on sulfur dioxide, long term NO_x emissions reductions are also desirable.

4. How Much Emissions Reduction?

Aquatic effects of acid rain have received the most careful quantitative study so it is these effects which provide a quantitative basis for emissions control. It is generally understood that the addition of sulfuric acid to a watershed is counteracted by various neutralization and soil absorption processes. However, after a sufficient time, soils can no longer absorb acid ions. Furthermore, the ability of the soil to furnish neutralizing (bicarbonate) material to the water flow may be exceeded by the amount of acid deposited into the watershed. Once the acid input exceeds the neutralizing output, the pH of waterbodies will fall with small increases in acid input, and waters become acidified. From observations at several locations in North America, it appears that for all but the most sensitive watersheds, acidification does not occur if wet sulfate deposition remains below 18 kg/hectare-yr.[6] For almost all sensitive areas of eastern North America, 1980 wet deposition was below 40 kg/hectare-yr. Thus, a 50% deposition reduction would protect all but the most sensitive watersheds from acidification. Figure 2 illustrates the effect of various deposition reductions and demonstrates that the unprotected area shrinks dramatically for a 50% reduction, but shrinks very little for small deposition reductions. We note that parts of all 31 eastern states currently receive 18 kg/hectare-year wet sulfate deposition, suggesting the need for a 31-state control program. We should note that significant acid rain has been occurring for only 30-40 years in eastern North America, and that some acidification effects may occur at lower sulfur deposition levels over a longer time.

The need for a 50% sulfur deposition reduction indicates that the control program designed to protect aquatic resources should include a 50 percent reduction in sulfur dioxide emissions distributed about the 31-state region.

5. Where and When to Make Sulfur Emissions Reductions?

Several principles can guide the choice of emissions reductions allocations among the states:

i. emissions reductions should be allocated so that all eastern sensitive areas, not just the Adirondacks, can achieve target deposition levels below 18 kg/hectare-yr.

ii. Although a uniform 50 percent reduction in SO_2 emissions would guarantee a 50 percent deposition reduction at all receptors, other strategies can produce similar deposition reductions while minimizing cost.

iii. Although detailed source-receptor relationships are not precisely known, the National Academy of Science report indicates that the atmosphere is generally well-mixed in the region from Tennessee and Illinois northeast over distances of 1000 km. Although the mixing is not perfect, particularly near the edges of the region, one expects the largest sources to make the largest contribution to deposition at most receptors. Large source states beyond 1000 km still make a significant although less than proportional contribution to deposition. Therefore, a given percentage reduction in SO_2 emissions within any such 1000 km region will tend to produce the largest deposition reductions at most receptors if focused on the largest sources. Furthermore, the Academy report noted that most of the acid rain falling at 3 locations analyzed in New York and Canada originated at sources lying in the direction of the Midwest. The study also showed that strong local sources, such as the Sudbury smelter, do not dominate local acid rain. In other words, sources well beyond the local region are important to sulfur deposition at most receptors.

These three principles lead to the conclusion that all Ohio Basin-Midwest coal burning states should be included in a control program. This region is a hub about which all sensitive areas in the 31-state region are located. Most sensitive areas are inside or within 1000 km of some coal burning states. Thousand kilometer circles around each sensitive area yield a set of mixing zones which cover the entire 31-state region (see Figure 3) and which overlap in the Midwest. Therefore, emissions reductions in the Midwest would strongly affect all sensitive areas. In contrast, emissions reductions in New York or New England, for example, have little effect outside New York and New England.

The importance of the Ohio Basin to a regional program is underscored by emissions inventories. The nine largest coal burning states emit nearly 2/3 of eastern SO_2 while the seven New York-New England states emit 6% of eastern SO_2. Furthermore, available analyses demonstrate that a 50% deposition reduction cannot be attained in the Northeast by tapping Northeast sources alone simply because not enough sulfur is emitted in the region. Even shutting off all Northeast sulfur sources entirely will not produce a 50% reduction in Northeast deposition.[8/] Therefore, target loading levels cannot be achieved generally unless Ohio Basin states participate in a reduction program.

In order to minimize the cost of the program, it may be desirable to deviate from a uniform 50 percent reduction by focusing the largest reductions in the Ohio Basin. Because of long-range atmospheric mixing, target loadings probably can be achieved at all sensitive receptors with the largest percentage reductions in the Midwest and other large emitter states, and lower percentage reductions in small-emitter states more local to those receptors. 9/ But target levels in most areas cannot be achieved if Midwest states are not included in the program. (See Appendix for an analysis of "Targeted" strategies.) Eliminating any large emission states from the program can only reduce deposition reductions obtained within 1000 km of those states as well as further afield, necessitating even higher reductions in the remaining states. For instance, Alabama emissions may not affect the Adirondacks strongly, but they have a large impact on sensitive watersheds in the Southeast.

In summary, a 31-state 50 percent SO_2 emissions reduction program with the highest reductions in the large-emission states probably can achieve target loadings in all eastern sensitive areas. The reduction in emissions in large emitter states will reduce pollution damage to crops, materials and human health and improve visibility in those states even in the absence of sensitive areas. A program which centers on the Northeast states will not benefit sensitive areas in the Southeast, the Great Smokies or the upper Midwest. A uniform program is probably unnecessarily costly.

A program centered in the Midwest may not produce exactly a 50 percent deposition reduction at all receptors, particularly very remote ones, but calculations indicate that a Midwest centered program produces a 40-65 percent reduction at all receptors.[9/] The lower reductions occur at receptors which do not need the full 50 percent reduction, since they currently receive deposition below 35-40 kg/hectare-yr, due to their remote location.

An acid rain control program should be legislated promptly. The current level of damage has accumulated in 30 years or so. We can only expect accelerating damages with the coming decades.

Michael Oppenheimer
Environmental Defense Fund

October 6, 1983

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APPENDIX

TARGETED STRATEGIES

Various proposals have been advanced for controlling acid deposition through "targeted" strategies. These strategies attempt to achieve sulfur deposition reductions at geographically concentrated receptor areas by focusing emissions reductions in a limited area proximal to those receptors. For example, the E.P.A. has considered proposals to reduce deposition in the Adirondacks and New England by reducing emissions by substantial amounts in Ohio, West Virginia, Pennsylvania, and perhaps Indiana, by lesser amounts in New York, New England and perhaps Michigan, and by zero elsewhere.

Such strategies fail to address the acid rain problem in several ways:

i. Receptor areas where acidification effects on the ecosystem have been reported are not restricted to a single geographical area. Observed effects have been reported in the Algoma region of Ontario, the Great Smokies in North Carolina, and in Florida. The OTA estimates that thousands of lakes and stream miles in the Southeast and upper Midwest have already been altered by acidification. Deposition in none of these areas would be reduced significantly by a strategy targeted on the Northeast.

ii. Thousands of lakes and stream miles in areas outside the Northeast are sensitive to future acidification, and require protection from the cumulative effects of acid rain which may not yet have been observed. A majority of watersheds in large sections of the South, the Appalachian chain and the upper Midwest, and much of southeast Canada fall into the "sensitive" category. Targeted strategies formulated for the Northeast are of little or no benefit to these areas.

iii. Even at the target receptors, a limited strategy may not have the desired effect on deposition. The 1983 National Academy of Science report on acid deposition leads to the conclusion that the broader the reduction program, the more likely that a substantial deposition reduction can be achieved at any receptor. Targeted strategies are based either on atmospheric models (with their attendant uncertainties) or on the vague principle that proximal upwind sources have the largest impact on a receptor per unit emission. However, sources beyond the range of the target program make significant contributions to deposition at the targeted receptors, so no compelling rationale can be forwarded for cutting any given state out of the program. The only way to guarantee that the desired deposition reduction is achieved at any receptor is to include all significant sources in all eastern states in the program.

iv. Even assuming that the model predictions are quantitatively accurate, proposed targeted strategies will generally fail to achieve the 17-20 kg/hect-yr deposition level even in the targeted areas precisely because they include only a few states. A fifty percent emissions reduction in a 10 or 12 state region will produce a much smaller deposition reduction at receptors in that region.

v. Targeted strategies have been advanced as an "experiment" to test the response of deposition and of ecosystems to emissions reductions. However, even a deposition reduction as large as 30 percent (as might occur in the Adirondacks in the larger target proposal) could not be unambiguously identified in deposition data for 5-10 years. More time may be required to identify the resulting ecosystem response (changes in surface water chemistry). If additional emissions controls await formulation until after the results of the experiment are interpreted, and if the experiment does not begin before 1990, areas not targeted in the "experiment" will not receive any protection until well into the 21st century. Ecosystems have experienced serious damage at current levels of deposition for 2 or 3 decades, and an additional increment of damage over a similar time period can be expected at most receptors during the "experiment".

vi. States omitted form the program continue to suffer surface water, crop, materials, forest and human health damage.

Thus, targeted strategies are neither an adequate acid rain abatement tool nor a satisfactory experiment if such an experiment is to be regarded as part of a 20th century control program.

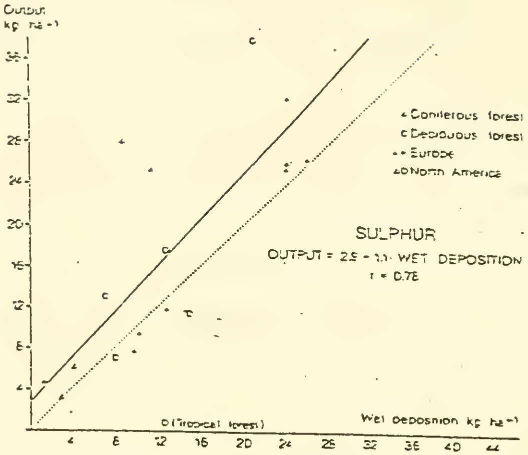

Figure 3. Annual input of $SO_4^{2-}-S$ by precipitation versus the leaching losses from forest watersheds and lysimeters with forest soils. Solid line is the regression line, dotted line is the 1:1 line. References as for Fig. 2.

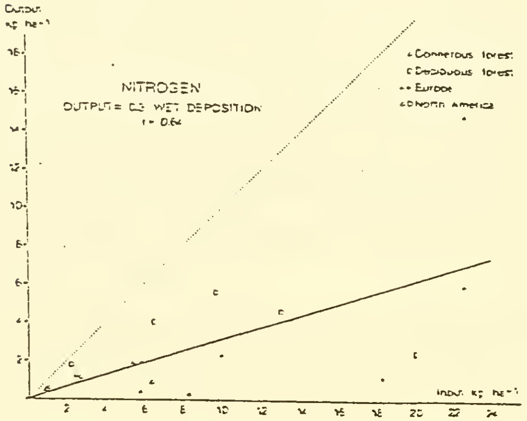

Figure 2. Annual input of $(NH_4^+ + NO_3^-)-N$ by precipitation versus the leaching losses from forest watersheds and lysimeters with forest soils. Solid line is the regression line, dotted line is the 1:1 line. Data from studies in Europe and North America — see text for references.

FIGURE 1
(From Ref. 3)

Output of sulfur and nitrogen from watersheds plotted vs. input due to wet deposition

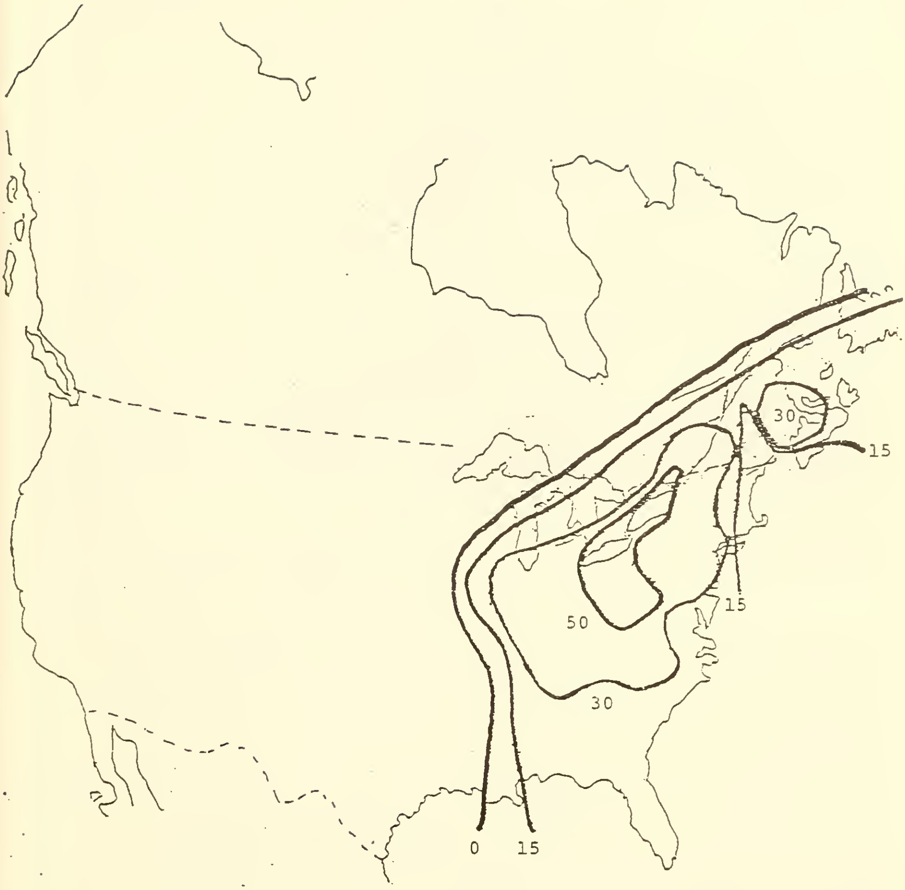

FIGURE 2.

18 kg/hect-yr wet sulfur deposition isopleth for a given percentage uniform sulfur deposition reduction from 1980 level.

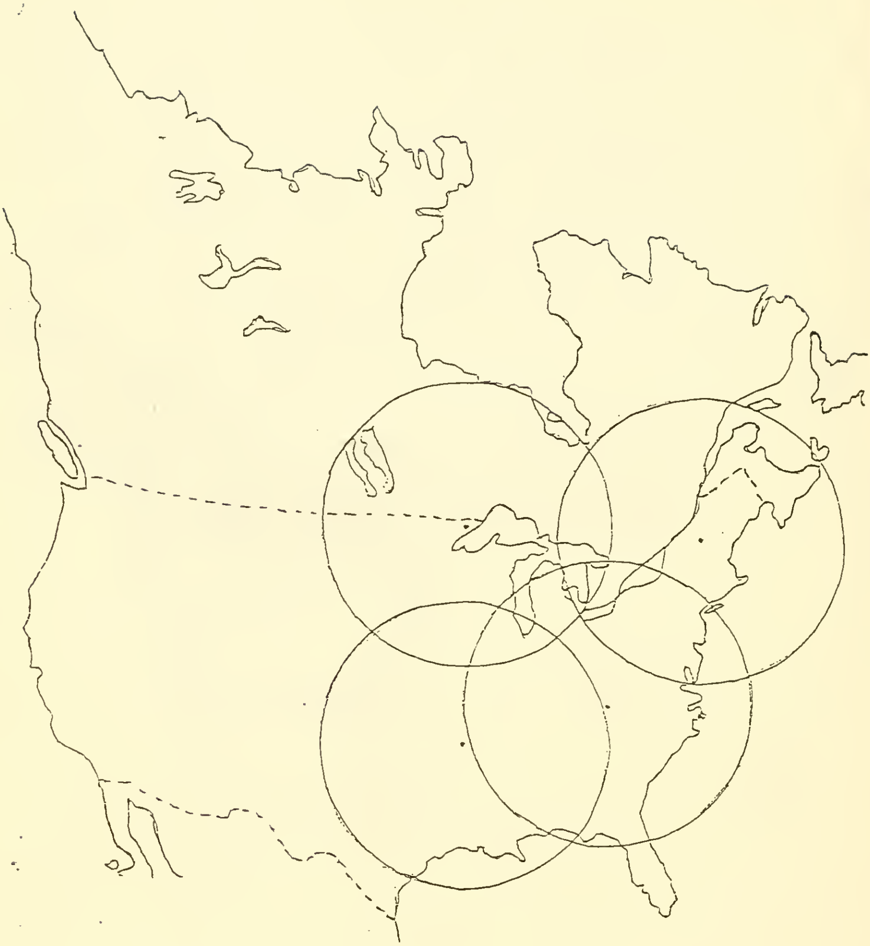

FIGURE 3

600-Mile radii about
four sensitive areas

Mr. Ottinger. Thank you very much.

Robin Gordon from the League of Women Voters.

STATEMENT OF ROBIN GORDON

Ms. Gordon. I am representing the League of Women Voters of New York State. We have approximately 10,000 members in 82 local leagues across the State. We appreciate this opportunity to address your subcommittee. The League of Women Voters of the United States has been working for a strong and effective Clean Air Act for over a decade and in the past 3 years this goal has been a top priority of our natural resources portfolio.

We particularly commend you and your subcommittee for the efforts you have made to meaningful reductions in air pollutants despite heavy resistance from a variety of industrial and governmental sources during the reauthorization process.

This year we were encouraged by the release of three reports contributing to the growing body of scientific knowledge that we believe represents a sufficient base, in fact a mandate, for legislative action. The accumulating data confirm the existence of a widespread and serious environmental threat that cannot be allowed to worsen.

I am going to change my submitted testimony here. In response to testimony that raised some of the following questions here today, we would just like to point out a few things.

Natural soil acidity does not explain the effect recently documented on buildings, stone monuments and the intrastructure of cities that has been attributed to acid rain. A second indication that indicates the interstate nature of this is the finding of trace elements of combustion products, I think cadmium and mercury, but I am not positive. I would have to look it up. Where those elements are not found naturally, indicating that they did arise out of State and were carried by interstate transport.

I will shorten my testimony regarding the impacts of acid rain here in New York, except to cite our concern over public health problems. Public water supplies are altered by the acidity which leaches heavy metals from the soil into water in toxic concentrations. Drinking water supplies are also tainted by the effect of acid water leaching lead and copper from distribution points in toxic amounts. This public health problem involves a major predictable and growing expense, as well. This is something that has not been pointed out.

The water supplies to the 2.5 million people of Boston must be treated with sodium hydroxide at the distribution point at a cost of $1.2 million per year to prevent toxic levels of lead in the water. The pipes are 85 percent lead in that part of the country. Boston's reservoir is not an isolated example. Surface water supplies in the Northeast will increasingly need this kind of treatment to remain potable and involve growing cost.

Summing up, we are witnessing a massive environmental phenomenon. We have now wasted 3 valuable years waiting for renewal of the Clean Air Act and acid rain control. We would note that in New York despite unilateral efforts requiring the burning of low sulfur fuel, as much as 75 percent of our air pollution arises out of State. Our attorney general has attempted to prevent some of this through litigation, but we are well aware that protection of the beauty and the health of our land lies only in prompt Federal action.

Specifically, we ask for a 50 percent reduction of sulfur dioxide from 1980 levels over the next 10 years, as recommended by the National Academy of Sciences, roughly a 12 million ton reduction. We are concerned about the possibility of actually increasing emissions as utilities convert from oil to coal and as industries recover.

We ask that sulfur dioxide reductions be based in anticipation of these factors on a net reduction with offsets required for any increased source of emissions. We strongly support the use of mandated technology on the 50 powerplants that are responsible for the largest and most identifiable emissions source. This provision enables the use of existing coal supplies and protects employment in those communities depending on coalmining jobs.

Finally, we ask that measures designed to list and control toxic air pollutants be accelerated and that is another story.

The League of Women Voters supports your bill H.R. 3400 because it will make significant reductions in the pollutants, sulfur dioxides and nitrogen oxides that cause acid rain. We are hoping to have the entire New York State congressional delegation cosponsor your bill. Currently 24 of the 34 Members of Congress are now cosponsors and we are directing our State efforts along these lines.

We, in New York, hope that if there is any positive benefit or lesson to be learned from the damage we are already experiencing, it would be to put aside minor differences and work toward the responsible goal of preventive action. We, who are aware of the problem, can do no less. Thank you.

[Ms. Gordon's prepared statement follows:]

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(212) 677-5050

ELIZABETH B. HUBBARD, President

CONGRESSIONAL FIELD HEARING ON H.R.3400

World Trade Center, New York City
December 1, 1983

My name is Robin Gordon and I am representing the League of Women Voters of New York State. We have approximately 10,000 members in eighty-two local leagues across the state. We appreciate this opportunity to address your subcommittee. The LWV-US has been working for a strong and effective clean air act for over a decade, and in the past three years this goal has been the top priority of our natural resources portfolio.

Mr. Chairman, we particularly commend you for the efforts you have made for meaningful reductions in air pollutants despite heavy resistance from a variety of industrial and governmental sources during the reauthorization process.

This year we were encouraged by the release of three reports contributing to the growing body of scientific knowledge that we believe represents a sufficient base, in fact a mandate, for legislative action. The accumulating data confirm the existence of a very widespread and serious environmental threat that cannot be allowed to worsen.

We in New York are particularly sobered by these findings. Two hundred and sixty of our lakes are acid dead with thousands more ~~another 10,000~~ in the Northeast ~~lakes~~ at risk of the same fate by the year 2000 should current levels of SO_2 emissions continue. Nor are the effects of acid rain confined to fish life.

Acid rain has resulted in public health problems. Public water supplies are altered by acidity which leaches heavy metals from the soil into the water in toxic concentrations. Drinking water supplies are also tainted by the effect of acid water leaching lead and copper from distribution pipes in toxic amounts. This public health problem involves a major, predictable and growing expense as well. The water supply for the two and a half million people of Boston must be treated with sodium hydroxide at a cost of $1.2 million per year to prevent toxic levels of lead in the water. Boston's reservoir is not an isolated example. Surface water supplies in the Northeast will increasingly need this kind of treatment to remain potable.

Sulfur dioxide's effect on respiratory function is another consideration. According to the American Lung Association, 50,000 deaths a year are attributed to this respiratory irritant. Its contribution to air pollution has cut visibility on the eastern seaboard by more than half, while at the same time eroding our statues, buildings, cars and bridges. All of these effects have costs--some measureable, some not.

Another warning we must heed is growing evidence that acid rain is affecting our forests. Research on Camel's Hump, Vermont's third highest mountain, documents widespread damage to red spruce, maple and birch trees. The forests of Scandinavia and Western Europe are dying and parts of the Black Forest in Germany are being limed as a temporary holding measure to retard damage there. Crops, notably tobacco, grapes and soy beans are beginning to show damage from lowered pH soils. And perhaps most troubling, estimates of soil and water pH change are being met and found earlier than predicted. We are witnessing a massive environmental phenomenon.

We have now wasted three valuable years waiting for renewal of the Clean Air Act and acid rain control. We would note that in New York, despite unilateral efforts requiring the burning of low sulfur fuel, as much as 75 percent of our air pollution arises out of state. Our Attorney General has attempted to prevent some of this through litigation, but we are well aware that protection of the beauty and health of our land lies only in prompt federal action.

Specifically, we ask for a fifty percent reduction of sulfur dioxide from 1980 levels over the next ten years, as recommended by the National Academy of Sciences--roughly a twelve million ton reduction. We are concerned about the possibility of actually increasing emissions as utilities convert for oil to coal and as industries recover economically. We ask that SO_2 reductions be based, in anticipation of these factors, on a net reduction with offsets required for any increased source of emissions.

We strongly support the use of mandated technology on the fifty power plants that are responsible for the largest and most identifiabl emissions source. This provision enables the use of existing coal supplies and protects employment in those communities dependent on coal mining jobs.

Finally, we ask that measures designed to list and control toxic air pollutants be accelerated.

The League of Women Voters supports your bill H.R.3400, Mr. Chairman, because it will make significant reductions in the pollutants, sulfur dioxides and nitrogen oxides, that cause acid rain.

We in New York hope that if there is any positive benefit or lesson to be learned from the damage we are already experiencing, it would be to put aside minor differences and work towards a responsible goal of preventive action. We who are aware of the problem can do no less. Thank you.

Mr. OTTINGER. Thank you very much.

Last, but by no means least, we will hear from George Davis, who is executive director of the Adirondack Council, Inc., in the area that has been most heavily impacted by the results of acid rain, and we thank you for your help, not only by being here, but also your very active concern about this matter and assistance to Congress in putting together this legislation.

STATEMENT OF GEORGE D. DAVIS

Mr. DAVIS. Thank you, Congressman Ottinger. Thank you, Mike, and Robin, I might add, also, for giving me a few minutes to regain my composure. I thought there for a minute I might become one of those irrational environmentalists.

I am George Davis, executive director of the Adirondack Council, and the only resident of the much-discussed Adirondack Park testifying today. My education and work experience have been in the fields of forestry and natural resource management. Adirondack Council is a nonprofit environmental organization concerned with the future of the 6 million acre Adirondack Park, its natural resources, and its people.

The council represents a coalition of five conservation organizations with a combined membership of more than 600,000 individuals. The council is the principle organization dedicated to land stewardship and environmental advocacy in the park.

The Adirondack Park that we have heard so much about today is composed of a mixture of both State and private lands. It is larger than the five largest national parks combined or larger than the entire State of Vermont. The park contains over 2800 lakes and ponds, 30,000 miles of streams and rivers, and the largest wilderness area in the Eastern United States.

The 120,000 permanent residents and the 9 million yearly visitors to the park have reason to be alarmed, for this magnificent area has already lost 212 of its lakes to the effects of acid rain, and 256 more are presently classified as endangered with a pH below 6.

The terrestrial and human health effects of acid rain are less well known than the aquatic effects, but the potential for damage is even greater. Studies throughout Europe show significant damage to forests and the same appears to be happening in the Adirondacks, Vermont and elsewhere.

It is ironic that the Adirondacks, a region renowned for its natural areas, should have been the first area in the United States to clearly show the devastating effects of acid precipitation. But although the Adirondacks may have brought the issue of acid rain home to many of us, it can now be shown that the Adirondack experience was merely a harbinger of things to come elsewhere.

Acidification of waters has been noted in Pennsylvania, the New Jersey Pine Barrens, the Appalachian Mountains of Maryland and North Carolina, the Berkshires in Massachusetts, the Green Mountains of Vermont, the White Mountains of New Hampshire and the lake country in Minnesota. The Rockies and other areas are also suffering from acid rain. The early death of Adirondack Lakes, serves as a warning to the rest of the country of the grim fate that awaits us if we do nothing to stop acid rain.

Despite Mr. Anderson and Dr. Brown's comments, the scientific debate over acid rain impacts was essentially ended this year by the National Academy of Sciences and others. It is time now to focus on control programs.

I am delighted with the broad support we have already heard today, especially the strong support we have been waiting for from Governor Cuomo. I was particularly pleased and the Council was pleased with his statement.

The National Acid Deposition Control Act of 1983 embodies the elements necessary to provide relief for our acid rain impacted areas, while at the same time protecting the jobs of midwestern coalminers and seeing that the cost for pollution control measures are equitably shared to alleviate excessive utility rate increases. My testimony is directed to these three points.

We seek emission reductions through H.R. 3400 with the scrubbers that have been discussed today. Our only additional comment, shortening what I have in my written testimony, is that we also favor Congressman Ottinger's amendment to raise the required annual sulfer dioxide reduction to 12 million tons.

I would like to also mention briefly something that has been glossed over all too often in this discussion, and that is the nitrogen oxide emission standards. We support H.R. 3400 in its 4-million-ton reduction here. These nitrogen oxides have often been glossed over and yet they contribute substantially, especially to the spring shock effect during periods of snowmelt.

The Adirondack Council is in full support of the bill's provision to require reduction of sulfur dioxide by the installation of scrubbers. While this may not entirely eliminate fuel-switching as a less costly method of reduction, it is the only feasible method to protect jobs by avoiding massive shifts. The resultant protection of jobs for the midwestern coalminer and the economic stability of an entire region of our country is a matter that is of extreme importance. As environmentalists, we are concerned with the total environment, human and natural resources.

It is difficult, if not impossible, to be environmentally aware and at the same time unemployed.

Provisions in H.R. 3400 to help limit the inevitable increase in midwestern utility rates by establishing a fund to help pay for pollution control equipment are supported. We believe that the fees to be imposed nationwide is equitable and, furthermore, right here in New York State, a recent poll conducted by researchers for the State University of New York and the Department of Environmental Conservation showed that New Yorkers are overwhelmingly in favor of comprehensive acid rain controls, even if it means an increase in their already high electric bills.

Mr. OTTINGER. Let me ask you to summarize at this point.

Mr. DAVIS. It is time to move ahead on acid deposition control legislation. We must leave behind the once firmly held and still generally true conviction that the pollutors must pay if we are to realize timely and equitable legislation. We cannot afford to further endanger our nation's health, water, forests and soil productivity.

The Adirondack Council is pleased to be given the opportunity to express its very strong support for H.R. 3400 as a bill which would move us in the right direction in our fight for clean air and a quality environment. Thank you.

[Mr. Davis' prepared statement follows:]

Testimony of
GEORGE D. DAVIS, EXECUTIVE DIRECTOR
of
THE ADIRONDACK COUNCIL, INC.

I AM GEORGE DAVIS, EXECUTIVE DIRECTOR OF THE ADIRONDACK COUNCIL, LOCATED IN ELIZABETHTOWN, NEW YORK, IN THE HEART OF THE ADIRONDACK PARK. MY EDUCATION AND WORK EXPERIENCE HAVE BEEN IN THE FIELDS OF FORESTRY AND NATURAL RESOURCE MANAGEMENT.

THE ADIRONDACK COUNCIL IS A NON-PROFIT ENVIRONMENTAL ORGANIZATION CONCERNED WITH THE FUTURE OF THE SIX MILLION ACRE ADIRONDACK PARK, ITS NATURAL RESOURCES, AND ITS PEOPLE. THE COUNCIL HAS APPROXIMATELY 3,000 INDIVIDUAL MEMBERS AND ALSO REPRESENTS A COALITION OF FIVE CONSERVATION ORGANIZATIONS (THE: ASSOCIATION FOR THE PROTECTION OF THE ADIRONDACKS, NATIONAL AUDUBON SOCIETY, NATIONAL PARKS AND CONSERVATION ASSOCIATION, NATURAL RESOURCES DEFENSE COUNCIL, WILDERNESS SOCIETY) WITH A COMBINED MEMBERSHIP OF MORE THAN 600,000; 65,000 OF WHOM ARE NEW YORK CITIZENS. THE COUNCIL IS THE PRINCIPAL ORGANIZATION DEDICATED TO LAND STEWARDSHIP AND ENVIRONMENTAL ADVOCACY IN THE ADIRONDACK PARK.

THE ADIRONDACK PARK IS COMPRISED OF A MIXTURE OF STATE AND PRIVATE LANDS: IT IS LARGER THAN THE FIVE LARGEST NATIONAL PARKS COMBINED OR THE ENTIRE STATE OF VERMONT. THE PARK INCLUDES OVER 2,800 LAKES AND PONDS, 30,000 MILES OF RIVERS AND STREAMS AND THE LARGEST WILDERNESS AREA IN THE EASTERN UNITED STATES. THE 120,000 PERMANENT RESIDENTS AND 9 MILLION YEARLY VISITORS TO THE PARK HAVE REASON TO BE ALARMED FOR THIS MAGNIFICENT AREA HAS ALREADY LOST 212 OF ITS LAKES TO THE EFFECTS OF ACID RAIN (CLASSIFIED AS CRITICALLY ACIDIC WITH A pH BELOW 5) AND 256 MORE LAKES ARE PRESENTLY CLASSIFIED AS ENDANGERED (BELOW pH 6).

THE TERRESTRIAL EFFECTS OF ACID RAIN ARE LESS WELL KNOWN THAN THE AQUATIC EFFECTS, BUT THE POTENTIAL FOR DAMAGE IS EVEN GREATER. STUDIES THROUGHOUT EUROPE SHOW SIGNIFICANT DAMAGE TO FORESTS AND THE SAME APPEARS TO BE HAPPENING IN THE ADIRONDACKS AND ELSEWHERE IN THIS COUNTRY.

IT IS IRONIC THAT THE ADIRONDACKS, A REGION RENOWN FOR ITS NATURALNESS, SHOULD HAVE BEEN THE FIRST AREA IN THE UNITED STATES TO CLEARLY SHOW THE DEVASTATING EFFECTS OF ACID DEPOSITION. BUT ALTHOUGH THE ADIRONDACKS MAY HAVE BROUGHT THE ISSUE OF ACID RAIN HOME TO MANY OF US, IT CAN NOW BE SHOWN THAT THE ADIRONDACK EXPERIENCE WAS MERELY A HARBINGER OF THINGS TO COME ELSEWHERE.

ACIDIFICATION OF WATERS HAS BEEN NOTED IN PENNSYLVANIA, THE NEW JERSEY PINE BARRENS, THE APPALACHIAN MOUNTAINS OF MARYLAND AND NORTH CAROLINA, THE BERKSHIRES IN MASSACHUSETTS, THE GREEN MOUNTAINS IN VERMONT, THE WHITE MOUNTAINS IN NEW HAMPSHIRE, AND THE LAKE COUNTRY IN MINNESOTA. THE ROCKIES AND OTHER AREAS ARE ALSO SUFFERING FROM ACID RAIN. THE EARLY DEATH OF ADIRONDACK LAKES SERVES AS A WARNING TO THE REST OF THE COUNTRY OF THE GRIM FATE THAT AWAITS US IF WE DO NOTHING TO STOP ACID RAIN.

BUT THE SCIENTIFIC DEBATE OVER ACID RAIN IMPACTS WAS ESSENTIALLY ENDED THIS YEAR BY THE NATIONAL ACADEMY OF SCIENCES AND OTHERS; IT IS TIME NOW TO FOCUS ON CONTROL PROGRAMS.

I WOULD LIKE TO THANK REPRESENTATIVE WAXMAN AND HIS SUBCOMMITTEE FOR THIS OPPORTUNITY TO ADDRESS THE ISSUES ARISING FROM HIS PROPOSED AMENDMENT TO THE FEDERAL CLEAN AIR ACT. THE "NATIONAL ACID DEPOSITION CONTROL ACT OF 1983", H.R. 3400, EMBODIES THE ELEMENTS NECESSARY TO PROVIDE RELIEF FOR OUR ACID RAIN IMPACTED AREAS WHILE AT THE SAME TIME PROTECTING THE JOBS OF MIDWESTERN COAL MINERS AND SEEING THAT THE COSTS FOR POLLUTION CONTROL MEASURES ARE EQUITABLY SHARED TO ALLEVIATE EXCESSIVE UTILITY RATE INCREASES FOR ANY ONE SEGMENT OF OUR POPULATION. MY TESTIMONY IS DIRECTED TO THESE THREE POINTS.

EMISSION REDUCTIONS

H.R. 3400 SEEKS EMISSION REDUCTIONS THROUGH AN INNOVATIVE APPROACH BY REQUIRING THE 50 UTILITY PLANTS EMITTING THE MOST SULFUR DIOXIDE TO INSTALL SCRUBBERS. THIS WOULD REDUCE THE TOTAL ANNUAL EMISSIONS BY 7 MILLION

TONS WHILE AN ADDITIONAL REDUCTION OF 3 MILLION TONS WOULD BE DIVIDED AMONG 48 STATES WITH NO SPECIFIC TECHNOLOGY REQUIREMENTS. BECAUSE THERE IS NO PROVISION FOR OFFSETTING FUTURE SOURCES OF SULFUR DIOXIDE THE NET REDUCTION MAY BE ONLY 7 OR 8 MILLION TONS RATHER THAN 10.

A RECENT NATIONAL ACADEMY OF SCIENCES REPORT CONCLUDED THAT A 50% REDUCTION IN SULFUR DIOXIDE EMISSIONS IS NEEDED TO PREVENT FURTHER DAMAGE BY ACID DEPOSITION. SEVERAL STUDIES INDICATE THAT A 12 MILLION TON REDUCTION IN SULFUR DIOXIDE EMISSIONS WOULD BE NECESSARY TO ACHIEVE THE 50% EMISSION REDUCTION GOAL. THE ADIRONDACK COUNCIL, THEREFORE, BELIEVES THAT NEW YORK REPRESENTATIVE RICHARD OTTINGER'S PROPOSED AMENDMENT FOR AN ADDITIONAL 2 MILLION TON REDUCTION IN SULFUR DIOXIDE EMISSIONS SHOULD BE ADOPTED. EVEN THIS WILL NOT BRING THE RATE OF ACID DEPOSITION DOWN TO A LEVEL THAT CAN BE ADEQUATELY BUFFERED BY ALL SOILS BUT IT WILL BE A MAJOR STEP FORWARD.

WE FULLY ENDORSE PROVISIONS OF H.R. 3400 THAT REDUCE NITROGEN OXIDE EMISSIONS BY 4 MILLION TONS BY TIGHTENING EMISSION STANDARDS FOR TRUCKS AND NEW COAL-FIRED PLANTS. NITROGEN OXIDES ARE OFTEN GLOSSED OVER IN DISCUSSING THE CAUSES OF ACIDIFICATION, YET THEY CONTRIBUTE SUBSTANTIALLY ESPECIALLY TO THE SPRING SHOCK EFFECT DURING PERIODS OF SNOWMELT.

JOBS AND THE SCRUBBER REQUIREMENT

THE ADIRONDACK COUNCIL IS IN FULL SUPPORT OF THIS BILL'S PROVISION TO REQUIRE REDUCTION OF SULFUR DIOXIDE BY THE INSTALLATION OF FLUE GAS DESULFURIZATION UNITS (SCRUBBERS). WHILE THIS MAY NOT ENTIRELY ELIMINATE FUEL SWITCHING AS A LESS COSTLY METHOD OF REDUCTION, IT IS THE ONLY FEASIBLE METHOD TO PROTECT JOBS BY AVOIDING MASSIVE SHIFTS. THE RESULTANT PROTECTION OF JOBS FOR THE MIDWESTERN COAL MINER AND THE ECONOMIC STABILITY OF AN ENTIRE REGION OF OUR COUNTRY IS A MATTER THAT IS OF EXTREME IMPORTANCE. AS ENVIRONMENTALISTS, WE ARE CONCERNED WITH THE TOTAL ENVIRONMENT: HUMAN AND NATURAL RESOURCES. IT IS DIFFICULT, IF NOT IMPOSSIBLE, TO BE "ENVIRONMENTALLY AWARE" AND AT THE SAME TIME UNEMPLOYED.

COST DISTRIBUTION

PROVISIONS IN H.R. 3400 HELP TO LIMIT THE INEVITABLE INCREASE IN MIDWESTERN UTILITY RATES BY ESTABLISHING A FUND TO HELP PAY FOR POLLUTION CONTROL EQUIPMENT. THE ADIRONDACK COUNCIL BELIEVES THE FEE (APPROXIMATELY $.60 ON THE AVERAGE FAMILY'S MONTHLY UTILITY BILL) TO BE IMPOSED NATIONWIDE IS EQUITABLE. FURTHERMORE, A RECENT POLL CONDUCTED BY RESEARCHERS FOR THE STATE UNIVERSITY OF NEW YORK AND THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SHOWED THAT NEW YORKERS ARE OVERWHELMINGLY IN FAVOR OF COMPREHENSIVE ACID RAIN CONTROLS, EVEN IF IT MEANS AN INCREASE IN THEIR ELECTRIC BILLS.

SUMMARY

IT IS TIME TO MOVE AHEAD ON ACID DEPOSITION CONTROL LEGISLATION. WE MUST LEAVE BEHIND THE ONCE FIRMLY HELD, AND STILL GENERALLY TRUE, CONVICTION THAT THE POLLUTER MUST PAY IF WE ARE TO REALIZE TIMELY AND EQUITABLE LEGISLATION. WE CANNOT AFFORD TO FURTHER ENDANGER OUR NATION'S HEALTH, WATER, FORESTS AND SOIL PRODUCTIVITY. THE ADIRONDACK COUNCIL IS PLEASED TO BE GIVEN THE OPPORTUNITY TO EXPRESS ITS SUPPORT FOR H.R. 3400 AS A BILL THAT WILL MOVE US IN THE RIGHT DIRECTION IN OUR FIGHT FOR CLEAN AIR AND A QUALITY ENVIRONMENT. THANK YOU. I WOULD BE PLEASED TO ATTEMPT TO ANSWER ANY QUESTIONS YOU MAY HAVE.

Mr. OTTINGER. Thank you very much.

We are supposed to vacate this room at 1 o'clock, but maybe we can stretch that a few minutes. I would like to take 10 minutes and just have some exchanges on the panel. First giving Mr. Anderson and Mr. Brown a couple of minutes perhaps to respond to some of the criticisms that were made of their testimony. And then I have seen Mr. Boyle jumping up and down. Maybe he and some of the other panelists would like to respond to that.

Mr. ANDERSON. As I indicated in my written testimony, those reports referred to by the others that the issue is closed, I disagree with completely. If you will read those carefully, they all say—we come to the following conclusions, based on the evidence we have to date. However, the evidence to date is far from conclusive.

And I have to stress that point because that is the point we are trying to make here. We do need more information to make informed judgments. Why should we spend extra money to achieve a goal that we may not even be able to achieve.

I think we need to do our homework better and make better public policy and I think we are premature.

Dr. BROWN. Mr. Chairman, Mr. Oppenheimer mentioned the obvious fact that acidified lakes are found only where acid rain falls. That is correct, because acid rain falls everywhere in the world. All rain is acid. Acidified lakes, he forgot to say perhaps, are found only in those places where the ground does not buffer the acid out and those tend to occur in places where granitic underlying soils do not have buffering capacity.

Second, Mr. Oppenheimer says, but they do find the sulfuric acid in the lakes and that is what proves it comes from the rain. If you put sulfuric acid through the soil, through the humus, more acid will come out than is put in, and it may be in various form—some of it will be sulfuric acid. Some of it will be some other type of acid. We do not say we need to take the sulfate out. We say more acid is produced by the soil itself than falls on the soil. And that unless that acid is buffered, the streams and lakes are going to become more into acidic. You should not forget that important point.

I just talked yesterday to some people in Connecticut who did the following experiment. They took humus from a conifer forest and they poured acid through it that was a hundred times more acid than acid rain. They found that 90 percent of the acid was taken out by the soil because the soil buffered the acid. The soil had such power, if you do not put acid into it, it puts acid out. If you put too much acid into it, it takes that out. It determines the acidity which flows into the lakes and streams. It is not the acid rain.

One more point I would like to make. Mr. Oppenheimer mentioned that in 1982 there was a conference in Europe at which they concluded that forests were being killed by acid rain. He did not mention that there was another conference in 1983 which came to the opposite conclusion. The 1983 conference ignored the claims of the 1982 conference and said it is highly unlikely that it is the acid rain which is affecting the forests, so at least Mr. Oppenheimer should give us the latest information. I thank you.

Mr. OPPENHEIMER. Let me just calmly correct some of the misstatements just made. First of all, it is true that all rain is slightly acid, though it is irrelevant. The fact of the matter is that there are widespread areas in this country where rain falls with a normal acidity range of pH of over 5, where the soils are just as sensitive as they are in the Northeast; and where no clear water acid lakes exist.

You can go to Oregon and Washington, for instance, and find sensitive soils, relatively high rainfall pH and no clear water acid lakes.

Second, a simple lesson in chemistry indicates that the ion balance in acidified lakes in the Northeast is dominated by the incoming sulfuric acid. The soil may be acid, but the acidity of the flow from the watersheds into those sulfuric acid lakes is not determined by the soil, but by the rainfall. Simple chemistry dictates that conclusion.

Third of all, I made no comment about tree damage and the Stockholm report. I merely indicated the 1982 conference acknowledged that acid rain was causing acidified lakes. I was not discussing forests.

Fourth of all, for the record, Mr. Ottinger, I forgot to thank you and congratulate you for your amendment.

Mr. OTTINGER. Thank you. Does anyone else want to contribute to the exchange or should we go to questions?

Dr. BROWN. On the question of these soils. I imagine that there might be some places where soils are sensitive and where the acidity of the lakes is less than in the Adirondacks. That is because, I would presume, when I say that the humus provides the acid to the soil, I was referring to the humus in the Adirondack region that comes from conifer forests.

There are several types of humus. If you have broadleaf forests, desiduous forests, you get what is called mull humus instead of mor humus. It is less acid. You do not get as much acid in some types of forests as you do in others. And there are probably some humuses which are formed where the surrounding watershed may have grasslands or special kinds of trees which are not the kind found in New York. So you would not have the same result everywhere.

It turns out that the humus which is formed from conifer forests, which is called mor humus, m-o-r, humus, is the most acid kind that you find anywhere in the world. And it is a special category. The amount of acid which comes out of the mor humus, after you put clear water through it, is four to five times as strong as the acid that is in the acid rain which comes out of the sky. So it should be no surprise that the acid in the lakes is then more acid.

And this nonsense about the simple chemistry shows that the sulfate content determines acidity, that has been exploded a long time ago. A report by Everrett and Associates in fact shows that the sulfate content of 40 Adirondack lakes correlates negatively with the acidity of the lakes. Negatively, not positively.

Mr. OTTINGER. Let me start off the questioning by asking you if, as you assert, the soil makes the primary contribution to acidification of lakes, why is it that we can measure a very substantial increase in acidity right after snows melt?

Dr. BROWN. I am very happy that you asked that question. You usually will find that in certain lakes, especially those near the steep side of mountain areas, are located where the runout is rapid.

With a combination of spring rains and melting snow, the volume of water which is running down the watershed is much greater than usual.

When that happens, the water has much less time to percolate down into the lower horizons and has much less time to be neutralized. It goes through the humus, does not have time to get much lower. Consequently the acidity is much stronger when the rush of water is greater. It does not have time to percolate to the deeper parts of the soil and get whatever neutralization that soil can provide.

Mr. OTTINGER. Does that not demonstrate though that the contribution of acid is indeed from the rainfall or the snowfall?

Dr. BROWN. No. It is worse than that. It is hard not to go through the humus, that is right below the forest floor.

Mr. OTTINGER. That is frozen.

Dr. BROWN. No, no. When the water is running off, it always goes through the litter and through the humus and some of it may percolate down deeper because it is melting.

Mr. SIKORSKI. In Minnesota, do not tell me where water comes from in terms of spring thaw. We walk on the soil, about a foot underneath the snow. The spring thaw does not penetrate the humus in all instances. You are denying the scientific data that you are trying to argue about.

Dr. BROWN. When you have the thaw and the snow is melting.

Mr. SIKORSKI. It all goes to the soil.

Dr. BROWN. It goes through the top layers of the soil, not the lower layers of the soil. Just the first few inches.

Mr. SIKORSKI. All spring runoff goes through the top layers of the soil?

Dr. BROWN. Essentially all of it. It only has to go through a quarter of an inch of humus in order to turn acid. That humus has a thousand times the acid of the soil, of the rain, excuse me, has a thousand times as much acid as all the rain which falls in the course of a year. It does not require very much. A centimeter will do it.

Mr. OTTINGER. Let me recognize Mr. Sikorski.

Mr. SIKORSKI. Well, I think you should close on that. You can refer to logic, human behavior or experience and the scientific data. I think what we have is a classic fight, turf battle, no pun intended, between the soil scientists and the air scientists.

Dr. BROWN. There is no fight between the soil scientists and the air scientists. There is no disagreement that acid rain falls with acidity in it. The question is what happens after it hits the soil. And I would like to refer you and give you a copy, if you want, of a recent paper that appeared in Science, and as far as I know there has been no rebuttal to that paper, and that your staff study it.

Mr. OTTINGER. Let me just dismiss the scientific panels that come to the opposite conclusion and that have taken your data into account. And they came out just foursquare. They said that we cannot specifically identify the source of disposition and correlate those two exactly, but that there is no question that the major contribution to the acid rain destruction of the lakes is from manmade sources. And that is where they came out.

Dr. Brown. I am saying in the study we did, we have a section, which is called the emerging scientific backlash. Only in the last year or so, perhaps 2 years, have scientists who have not been consulted been starting to publish papers, and this is one of them, and there are other references in the text. On the first Academy of Sciences' panel, there were no soil scientists representing this point of view who were invited to join the panel. This point of view did not receive a representation.

If you will ask scientists today who have gone through this evidence, you will find that their position in modified in many cases. At least if they are not members of the Environmental Defense Fund. If you pick a University, ask to speak to soil scientists.

Mr. Sikorski. Has your report, Dr. Brown, been peer reviewed?

Dr. Brown. This has been peer reviewed, yes.

Mr. Sikorski. Is it the report you are talking about?

Dr. Brown. Yes. This report in Science has been peer reviewed, yes. And I offer it to you.

Mr. Sikorski. Who are the scientists who were on the peer review?

Dr. Brown. Who were on the peer review? I do not know. This is not my report. This is the report I referred to in Science by, Dr. Edward C. Krug, and Dr. Charles C. Frink of the Connecticut Agricultural Experimental Station.

Mr. Ottinger. Mr. Sikorski.

Mr. Sikorski. I think it flies in the face of logic. It ignores the telescopic degradation. The amounts of rain have been relatively equivalent over hundreds of years. And the process by which they penetrate the humus and receive the acidification that you are blaming, the problems we have with our lakes and streams and human health and the rest, then the telescopic degradation that has occurred parallels the increase of sulfur and nitrogen oxides in the air released through the rain or other deposition processes would not occur.

Second, the spring thaw would not occur.

But I want to turn to Mr. Anderson who made some very provocative, all of you made very helpful comments, some more helpful than others. But I wanted to turn to Mr. Anderson's comments wherein in the early part of your statement you focused on the positive, wonderful things that have occurred in New York, in relationship to the last 10 or 15 years of environmental controls.

I wonder how many of those your organization supported at the time they were adopted, either by bureacracy or by legislative decision?

Mr. Anderson. Well, it is hard for me to reflect on that because I have worn two hats in my career. I have been a pollution control engineer with the State of New York and over the last few years have worked with the utilities, so I have had a career that has put in equal dimensions in State pollution control activities as well as utility efforts.

Mr. Sikorski. Let me just suggest it is probably closer to none or few, if any.

Mr. Anderson. I think you are incorrect, by the way, on that.

Mr. Sikorski. Well, maybe then you have a chance to submit for the record the things you have supported.

Mr. ANDERSON. Yes, I have.

Mr. SIKORSKI. You make a statement in reference to section 193 of H.R. 3400 that is absolutely patently absurd, by any reading of that language. And I have looked at it and the staff has looked at it, and looked back at your statement. There is no ambiquity. The intention of the people who drafted this is legislative and the language is clear.

Did you do this legal analysis or did someone else do this analysis?

Mr. ANDERSON. It has been reviewed by a number of people. That is one interpretation. I hope what you are telling me is absolutely correct.

Mr. SIKORSKI. I taught legal writing and whoever prepared that analysis should have gotten an F. It strikes me that the approach that the one analysis that you chose to take was to come up with the most logical extreme critical comment about it and then raise it as some kind of legitimate concern. I would suggest at this stage of the game, it might be more helpful to focus on what is genuine in concern and not cloud the issue with this type of argumentation. It just is not there. I think if you look at it, you might agree. You guys made me happy and sad today. Sad for your comments but happy because I won a bet. I said when I looked at the panel, that you from the utility industries were going to come in and champ the mantra that we have been hearing, which is that there is no problem with acid rain. Well, if there is a problem with acid rain, we do not contribute to it. And, finally, if there is a problem with acid rain, and we might be partially or somewhat responsible, that what you are proposing is too costly, too ambiguous, too administratively difficult. It creates acne and everything else. You fulfilled that.

But I am concerned that we close off the scientific debate. After all the witnesses, the 6,000 reports that are available, the information from the National Academy of Science, the White House, Office of Science and Technology, that we close off that part of the debate which says that there is no problem. Or if there is a problem, it is created by ducks or by God or by Smokey the Bear, or whoever you want to blame for acidification. And look at what the great volume of scientific data and the scientists are telling us, and get on with the problem of fashioning a response that is a cheap as possible, that also looks at the cost of acid rain, that is as workable and quick as possible, that is helpful and painless as possible. I think that the train is leaving the station. If your utilities want to get on, you still have some opportunity before this legislation is passed and I encourage you to. Get involved in that process.

My utilities in my State and some of the others throughout the country are now recognizing that and joining with the ratepayers for whom they are not speaking, but like to speak about in trying to fashion acid rain control. I hope you would look at that, Mr. Anderson.

Mr. ANDERSON. I think if you will note it, in my summary statement I have asked two things of Congress, and especially your subcommittee to take a look at. Better ascertain the nature of the problem that has been alleged here, and partially defined. And, second, make sure that if we are going to solve it, let us do it in the most reasonable and cost-effective manner. Those are my two points. So I do not think we are at great odds with that. And your comments on section 193 I appreciate. I hope it is interpreted that way if this legislation does come forth.

Mr. SIKORSKI. Let me, Mr. Chairman, just read from the Office of Science and Technology one section.

"It is in the nature of the acid deposition problem that actions have to be taken despite imperfect knowledge. If we take the conservative point of view that we must wait until the scientific knowledge is definitive, the accumulated deposition and damaged environment may reach the point of irreversibility."

That is not something that we, or you utilities, would like to reach.

Dr. BROWN. But I think, Mr. Chairman, you are quoting one personal opinion. And, second, I would like to ask you to consider that I would make the following prediction, that within 1½ to 2 years among scientists you will find a reversal of sentiment about whether acid rain causes the effects on lakes and forests. I am not talking about health or crops or some of the other ones. The principal focus today of the effect of acid rain is on the Adirondack lakes.

On that issue I will assert you are very likely to be dead wrong if you think acid rain is the cause, and it will not take more than a year or two to find it out.

Mr. SIKORSKI. The largest acid rain study conducted in the world right now is being conducted in northern Minnesota and northern Wisconsin and northern Michigan, by Dr. Glass of the EPA Lab in Duluth, Minn. So focusing on Adirondacks has nothing to do with that.

Mr. OTTINGER. Also, this is by no means a localized problem. The Canadian Parliament has been down here time and time again. They are up in arms about the destruction of their lakes. I understand that the Germans are tremendously concerned about this because of the destruction of the Black Forest. The Scandinavian countries are enormously concerned about the sulfur dioxide being emitted in the valley which is destroying their lakes, so this is by no means an Adirondacks problem. It is a problem which is increasingly absorbing the concern of nations all over the world.

Dr. BROWN. You are exactly right, Mr. Chairman. I think they should be concerned and in many cases I would not be surprised if sulfur dioxide, as distinguished from acid rain, is a problem. And it is certainly true in Canada where they emit a lot of sulfur dioxide.

Mr. OTTINGER. Let us assume for the minute that you are correct and the main contributor to the killing of lakes is not the acid rain itself, but is——

Dr. BROWN. The soil.

Mr. OTTINGER. Acidity that is contributed by the soil's natural phenomenon. Still it seems to me that there is enough evidence of damage from sulfur dioxide to make it worthwhile to embark on a program to get rid of it, even if the acid rain problem is not primarily caused by it. Do you disagree with that?

Dr. BROWN. No. As a matter of fact, in our report——

Mr. OTTINGER. You do not disagree?

Dr. BROWN. I do not disagree with the idea of making the air cleaner over time. The thing that I disagree with is to use the wrong evidence to come to a conclusion that you must engage in a hurryup retrofit program which will not solve the problem. That is what I am against. I am not against spending money for cleaner air. I am in favor of it. And I approve the things that the EPA has done. And in our report we recommend that they do it and more so in the future and the problem disappears by itself as the capital stock turns over.

We recommended that if the EPA required new installations to use all new technology, you know, to use the latest and the best available, over time the problem disappears by itself, without having to inflict intense social burden on Ohio or some other local region because they are going to have to go back and retrofit.

Mr. OTTINGER. So your main disagreement then is a matter of timing. You do not think there is the urgency to act with respect to existing sources, worldwide, of sulfur dioxide contribution.

Dr. BROWN. I am focusing more on the United States. What they want to do in Europe, they may have some special sulfur dioxide problems in Europe. I am not sure. That has to be determined.

I am saying that the evidence about the lakes is wrong. The evidence about the forests is highly questionable. The evidence about other effects are sort of a potpourri of claims, none of which have been established. And we are not in an emergency situation, where we have to go out and spend a lot of money on retrofit plans and inflict a lot of damage on specific parts of the country.

Mr. OTTINGER. The scientists that participated in this acknowledged the margin of error and said that regardless they thought the evidence was sufficient to proceed. You seem to be just absolutely, categorical opposed. Do you think you can be wrong?

Dr. BROWN. I am not quoting my own evidence. I am saying that the best investigation I have been able to make looking at not only this paper, but a set of papers, there is a large body of scientists who have not been heard from who are emerging, who want to be heard from before the political decision is made. At least I would guess that would be true.

And I think that the scientific evidence for the major claims against acid rain will not be persuasive within a year or so as the evidence comes cut.

Mr. OTTINGER. We are going to have to wrap up.

Mr. SIKORSKI. Mr. Chairman, a unanimous consent request On the basis that this type of discussion is very helpful, and used on the floor of the House when we debate this, I might at this point make unanimous consent request that from the National Academy of Sciences study, that the scientists listed as members of the committee on atmosphere and their liaison and staff, as well as the members of the board on agriculture and renewable resources and the commission on natural resources, as well as acknowledgements found on page iii, iv, and v, of the study, be entered into the record, so that the record is complete, and we see who is on what side.

Mr. OTTINGER. Without objection, it is so ordered. I wish we could go further because it is a fascinating topic and it is one I am sure we cannot resolve here today. I do think the differences have been laid on the table.

If any of you wish to supplement the record by addressing problems that you feel you did not address adequately in your testimony today, we will leave the record open to permit you to do that.

We want to thank you very much for your help. Thank you. The hearing is adjourned.

[Whereupon at 1:15 p.m., the hearing was adjourned.]

[The following letters and statements were submitted for the hearing:]

State of New York Executive Department
Adirondack Park Agency

Theodore M. Ruzow
Chairman

Vincent J. Moore
Executive Director

November 30, 1983

Honorable Henry Waxman
Chairman
House Energy and Commerce
  Subcommittee on Health and the Environment
House Office Building
Washington DC 20515

Dear Representative Waxman:

Re: Hearings on H.R. 3400
December 1, 1983

The Adirondack Park Agency is the agency of the State of New York charged by law with service as the forum for the development of long-range policy for the Adirondack Park. The Adirondack Park Agency Act requires that policy to recognize a major State interest in the conservation of the Park's resources.

On August 19, 1983, in furtherance of that mandate, the Agency adopted the enclosed Air Quality Policy, which we respectfully submit for inclusion in the record of the above.

Sincerely,

Theodore M Ruzow

Theodore M. Ruzow
Chairman

TMR:ab

Enclosure

P.O. Box 99 Ray Brook, New York 12977
Telephone (518) 891-4050 XXXXXXXXXXXXXXXXXX

DRAFT FOR AGENCY MINUTES

State of New York Executive Department

Adirondack Park Agency

Theodore M. Ruzow
Chairman

Vincent J. Moore
Executive Director

AIR QUALITY POLICY
August 19, 1983

WHEREAS, the New York State Adirondack Park air, land and water resources are affected by acid deposition; and,

WHEREAS, acid deposition is caused by SO_2 and NOx emissions into the atmosphere, both locally and in remote locations; and,

WHEREAS, the federal Clean Air Act is one of the most important sources of standards to control such emissions; and,

WHEREAS, the National Clean Air Coalition, a broadly based association of organizations concerned with human health, air quality, and the environment, has organized information on key aspects of this issue,

NOW, THEREFORE, BE IT RESOLVED,

The Adirondack Park Agency endorses the position of the National Clean Air Coalition and finds, in particular, the following to be necessary elements of national clean air legislation:

1. A percentage of reduction in SO_2 emissions from 1980 levels, which current studies indicate is 50%, from at least 21 eastern states and Canada over 10 years. The final number of states in the reduction region should be determined on the basis of an allocation formula which results in maximum reductions in acid deposition in the Adirondack Park. New sources should also be offset.

2. More stringent controls for future NOx emissions from both mobile and stationary sources. Increases above NOx emissions in 1980 must also be offset in any SO_2 emission reduction program.

3. Designation of the Adirondack Park as a Class I area for the prevention of significant deterioration of air quality.

4. A USEPA program that sets a time within which potentially toxic air emissions are evaluated, and which provides that such emissions will be presumed hazardous unless proven otherwise after that time.

As a precondition to urging the above as national policy, the Adirondack Park Agency believes that the State should impose the same or stricter standards on in-state SO_2 and NOx emitters, if necessary to achieve equivalent reductions in the State of New York.

DISCUSSION

Under Section 801 of the Adirondack Park Agency Act, the Agency is assigned "the responsibility for developing long-range park policy in a forum reflecting statewide concern."

The Agency is addressing the federal Clean Air Act and acid precipitation because of widely acknowledged problems for the region. The Agency will communicate its views to the state Administration to assist in shaping statewide policies that reflect the Adirondack Park's protection as well as the other various economic and environmental issues that characterize our large and complex state.

SCENIC
HUDSON INC
9 VASSAR STREET · POUGHKEEPSIE, NY · 12601 (914) 473-4440

12/1/83

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COMMENTS FOR THE HEALTH
AND THE ENVIRONMENT SUBCOMMITTEE OF
THE HOUSE OF REPRESENTATIVES ON
H.R. 3400

STATEMENT OF SUPPORT

On behalf of Scenic Hudson, a non-profit environmental organization with 12,000 supporters throughout New York State, I would like to commend the Sub-Committee for convening hearings on H.R. 3400, a bill to address the problem of acid precipitation, commonly known as acid rain.

Scenic Hudson has been involved in State and Federal legislation and sponsored numerous public education forums dealing with various aspects of acid precipitation in New York State. Scenic Hudson supports the Waxman-Sikorski Acid Rain Control Bill (H.R. 3400) with an amendment that would increase the sulfur dioxide emission reductions to 12 million tons or fifty percent. This amendment is being developed by Congressman Ottinger's office.

The adverse impacts of acid rain on our lakes, streams, drinking water, public health, buildings, certain agricultural crops and forests have been documented extensively in numerous scientific reports prepared by governmental and non-governmental bodies. Studies by the New York State Department of Environmental Conservation (NYS DEC) point out that over 200 lakes in the Adirondacks have been deprived of life due to acidification. Here in the Hudson Valley, Dr. George Hendry documented through laboratory tests that some 20 lakes in the Hudson Highlands are highly sensitive to acidification. Rainfall in that area has an average ph of 4.0, approximately 40 - 50 times more acidic than normal rain. In Poughkeepsie, NY, Scenic Hudson, in cooperation with the Vassar College Chemistry Department, has been testing the ph of rainwater this fall. The average ph of five rain events tested was 4.1, with the lowest reading being 3.5 on November 10, 1983.

In New York City and other cultural centers, acid rain is reshaping our historic heritage by deteriorating the structures of buildings and wearing away the form of treasured art. In addition, the National Academy of Science has estimated the annual economic cost of acid rain to be five billion dollars.

New York State sources emit about 942,000 tons of the 22.5 million tons of SO_2 discharged in the Eastern United States annually. This amount is more than the total SO_2 emissions from all of the New England States and New Jersey combined. Both utility and non-utility based sources contribute to this total equally.

While it is true that New York State had reduced sulfur emissions significantly over the past 15 years -- 43% from 1965 to 1980 -- other regions of the country have also achieved reductions. Examining that region most often accused of "causing" New York's acid problem -- the Mid-West (EPA Region V) -- one finds that over the same time period this region experienced a 24% decline. Thus, it is incorrect for New York State to portray itself as the only state which has reduced SO_2 emissions as a means of persuading other, Mid-Western states, to accept a larger relative share of the mitigation burden. It is also important to note that New York State projected emissions have increased by approximately 100,000 tons since 1980.

Dr. Michael Oppenheimer reported that New York State contributes between 1/4 and 1/3 of the SO_2 emissions that fall back on the State's resources in the form of acid rain. While the Ohio Valley is the major contributor to our acid rain problems, it is imperative that New York State is incorporated in a national sulfur dioxide emission reduction policy and program to effectively control the social, environmental and economic impacts of acid rain.

Scenic Hudson strongly supports a national sulfur emission policy seeking a 50% reduction of SO_2 emissions. The technology is available to achieve this goal. Reduction of the sulfur content in fuel and installation of Best Available Control Technologies (BACT) such as scrubbers and newly-developed Limestone Injection Multi-Stage Burners (LIMB) are some examples. The long-term economics of these proposals to the rate payer are not of significant impact. The cost of a 50% reduction was estimated at 1 - 3 percent in the most costly year in an ICF, Inc. report prepared for the Office of Policy Analysis of the Environmental Protection Agency in February of 1983 for New York State citizens. In addition, it has been documented that significant cost-savings can still be achieved when using BACT in coal conversion cases. These reasonable costs, along with the need to prevent further damage and long-term financial burdens of our environment and economy, demonstrates the cost-effectiveness of a 50% reduction policy.

Scenic Hudson urges the support of H.R. 3400 with an amendment that would achieve a fifty percent reduction of sulfur dioxide emissions.

Thank you.

Dave Miller
Environmental Program
Coordinator
Scenic Hudson, Inc.
9 Vassar Street
Poughkeepsie, NY 12601

Hudson River Sloop
CLEARWATER Inc.
112 Market Street, Poughkeepsie, N.Y. 12601 914/454-7673

December 1, 1983

Honorable Henry Waxman, Chairman
Sub-Committee on Health and Environment
House of Representatives
Washington, D.C. 20515

RE: Waxman-Sikorski Acid Rain
Control Bill (HR-3400)

Dear Congressman Waxman:

The Hudson River Sloop Clearwater, Inc. commends you for your leadership role in the promulgation of acid precipitation control legislation. We wholeheartedly support HR-3400.

However, with the recent recommendation of the National Academy of Sciences, we hope that you will also consider and support amendments to the bill which would allow for a total reduction of twelve million tons or more of sulfer dioxide emissions. Offsets for future growth are indeed a critical issue in planning for total sulfer dioxide emissions. We would hope that the strengthening of this legislation would include offsets in the total reduction planning.

In your deliberations today on this critical issue, please consider Clearwater in complete support of your initiatives to control acid precipitation.

Sincerely,

John Mylod
Executive Director

JM/jht

All contributions are tax deductible under section 170 of the Internal Revenue Code

SIERRA CLUB
MID-HUDSON GROUP — ATLANTIC CHAPTER
BOX 1012 POUGHKEEPSIE, NEW YORK 12602

December 1, 1983

To: Congressional Sub-Committee on Health and Environment
Re: Statement of Support for H.R. 3400 (with amendment)
The Acid Rain Deposition Control Act of 1983

The Mid-Hudson Group of the Atlantic Chapter of the Sierra Club endorses an amended version of H.R. 3400. As written, it would not achieve the 50 percent reduction in sulfur dioxide emissions called for by the National Academy of Sciences. Without requiring offsets for new sources of sulfur dioxide pollution or providing for an increase in the gross reduction of sulfur dioxide emissions from 10 to 12 million tons, the bill will achieve only about an 8 million ton reduction in sulfur dioxide emissions. We think that this needs to be strengthened. We therefore support Congressman Ottinger's amendment to H.R. 3400 which would increase sulfur dioxide emissions reductions from 10 million to 12 million tons per year.

Inorder to protect the lakes and forests of the Hudson Highlands and those of the Shawangunk Mountains, many of which are polluted by deposits of acid rain, we need a full 50 percent reduction (12 million tons) in sulfur dioxide emissions NOW! We are particularly concerned about some of the lakes, which are already in a critical stage. The potential impact of acid rain deposits on the commercial crops and apple orchards of the Mid-Hudson area, is also of the utmost concern.

We trust that the story of H.R. 3400 will not be one of "too little, too late."

Pera G. Gorson

Pera G. Gorson, Mid-Hudson Sierra Club
Vice-Chair and Conservation Chair for
National Issues

To explore, enjoy, and protect the natural scene
PRINTED ON RECYCLED PAPER

November 30, 1983

Congressman Henry Waxman
Chairman of Congressional Subcommittee
on Health and Environment

The Citizens Against Pollution strongly supports the enactment of the Waxman-Sikorski bill H.R. 3400 in its entirety.

Our organization believes that this legislation represents the only effective means of combating the acid rain problem at this time.

We know that the absolute reduction of sulfur dioxide emission is the only way to control acid rain. The questions regarding the existence of acid rain and its consequences have been answered. The National Academy of Sciences has recently confirmed the direct relationship that exists between sulfur dioxide emissions and acid rain. This report also documents the harmful effects that acid rain causes on a wide variety of subjects. A program which maintains current emission levels will obviously fail to alter the destruction caused by acid rain.

The necessary technology to resolve the sulfur dioxide emissions problem is currently available. Practical flue gas desulfurization installations and fluidized bed combustion facilities are on line today. What is missing is the legislation which would require the nations utilities to install such equipment.

The doubts raised by the utility industry relating to the costs and financing of these programs are short-term, self-serving policies designed to protect earnings. We view these programs as an opportunity for real capitol inventment which would strengthen our immediate future. The economic consequences we face today are insignificant when compared with the collective destruction our present acid rain future will surely produce.

Again, we urge everyone involved in this process to be honest and pragmatic about the consequences of not initiating an effective acid rain program now.

Thank you,

CITIZENS AGAINST POLLUTION

Tomkins Cove, New York

dum

We Also support an Amendment being developed by ressmen Ottinger (D-NY) to increased Sulfur dioxide emission reductions 2 million tons (50%).

Citizens to Preserve the Hudson Valley, Inc.
P.O. BOX 412 • CATSKILL, NEW YORK 12414 • (518) 943-5042

December 1, 1983

The Honorable Henry Waxman
Chairman
Congressional Sub-Committee on Health
and Environment
United States Congress

Dear Congressman Waxman:

Citizens to Preserve the Hudson Valley supports the Waxman-Sikorski Acid Rain Control Bill (HR-3400) as an important step toward controlling sulfur dioxide emissions and easing the adverse environmental impacts of acid rain experienced in the Northeastern United States.

We also support the Ottinger Amendment to limit the emissions by an additional two million tons.

We believe the legislation poses a balanced approach to a critical problem by addressing the costs of pollution control equipment and seeking to prevent major unemployment in the coal mining industry.

The nation must increasingly depend upon coal as fuel. The adverse effects of coal burning must be addressed now to prevent a significant deterioration of the quality environment we have worked so hard to build over the past decade.

Citizens to Preserve the Hudson Valley has been active in energy issues and utility rate cases since 1973. We are concerned that the energy needs of the country be provided in a balanced, environmentally sound manner. Our membership is drawn primarily from Green and Columbia Counties. Our activities have involved us in policy making processes on the state and federal level that affect our energy future and the quality of life for our own communities as well as that for the region and nation as a whole.

We support the continued use of coal as an indigenous energy supply which is plentiful, but recognize that the problems associated with the burning of coal must be addressed. This legislation is a step in the right direction.

Sincerely,

Loretta M. Simon
Loretta M. Simon
President

Baltimore Woods HISTORIC LAND USE CENTER

Centers for Nature Education, Inc.

P.O. Box 133 315-673-1350
Bishop Hill Road
Marcellus, N.Y. 13108

November 28, 1983

Dear Congressman Waxman:

Upstate New York is a wonderful place to live. Aside from all the usual attributes, we also have Lake Ontario, the Finger Lakes, and the Adirondack Mountains within a 2 hour drive. Fortunately we also have a great supply of limestone in our soils, to buffer the effect of acid rain.

I am still very concerned about the effect of acid rain, in fact acid deposition and would like to go on record as supporting the Waxman-Sikorski Acid Rain Control Bill (HR-3400). I would also support an amendment to further limit reductions of sulfur dioxide emissions by 12 million tons (50%).

Sincerely,

John W. Gramlich

JOHN W. GRAMLICH
Director

JWG/ebt

League of Women Voters
of Dutchess County, New York

November 30, 1983

The Honorable
Henry A. Waxman
World Trade Center

Dear Representative Waxman,

The League of Women Voters of Dutchess County joins the National Clean Air Coalition and other national, state and local environmental groups in recognizing the importance of the Waxman Sikorski Bill HR 3400 in the fight against acid rain. We also strongly endorse the Ottinger Amendment.

Since the early 1980s the League has advocated strengthening the Clean Air Act in two ways: accelerate comtrol of toxic air pollutants; and require control of the sources of acid rain. State, Local and Regional Leagues continue to monitor enforcement of state implementation plans and to campaign for a strong and effect Clean Air Act.

We in the Mid-Hudson Valley are concerned with the cumulative effects of acid rain from regional and more distant sources. We support HR3400 and recommend the Ottinger Amendment. Together they offer protection for the natural and historic resources of our region, New York State and the country

Sincerely yours

Elayne Weinstein

Elayne Weinstein
President

cc: The Honorable Hamilton Fish, Jr.

LIFE CENTER
Local Involvement for Environment

Central School
Palmer Avenue
Larchmont, New York, 10538
(914)834-4188 (914) 834-4261

To: The Congressional Sub-Committee on Health and the Environment

From: L.I.F.E. Center

The Larchmont-Mamaroneck L.I.F.E. Center supports the Waxman-Sikorski Bill #3400 with an amendment asking for a 50% reduction of sulpher dioxide emissions.

Sincerely,

Elizabeth Stern, Executive Director

Hudson River Shorelands Task Force
(914) 876-7484 BOX 29, RED HOOK, N.Y. 12571

November 28, 1983

COMMENTS FOR THE CONGRESSIONAL SUB-COMMITTEE ON HEALTH AND THE ENVIRONMENT REGARDING THE WAXMAN-SIKORSKI ACID RAIN CONTROL BILL (HR-3400)

Dear Chairman Waxman:

The Hudson River Shorelands Task Force supports the Waxman-Sikorski Acid Rain Control Bill with an ammendment that would increase the sulfur dioxide emission reductions to 12 million tons. This level of emission reduction is consistant with a fifty per cent national control program, as recommended by the scientific community. The ammendment is currently being developed by Congressman Ottinger's office.

Acid Rain is a problem that impacts the environmental, cultural and social resources of the Hudson Valley. In order to prevent future damamges, a national program must be undertaken to control the pollutants that contribute to acid rain.

Therefore, the Hudson River Shorelands Task Force strongly urges the committee to support HR 3400 and a fifty percent (12 million ton) control program fpr sulfur dioxide emissions.

Very truly yours,

SAVERIA L. MAZZARELLA, CHAIRMAN
HUDSON RIVER SHORELANDS TASK FORCE

FOUNDED
1958

RALPH T. WATERMAN
BIRD CLUB, INC.
Dutchess County
New York

Affiliated with:
Federation of New York
State Bird Clubs
National Audubon Society
Nature Conservancy

Nov. 26,1983

Dear Mr. Ottinger:

The Ralph T. Waterman Bird Club of Dutchess County, New York, comprising 266 members, strongly urges the members of the Congressional Hearing on Acid Rain to support the Waxman Bill (H.R. 3400) with the Ottinger amendment.

Our club has long been concerned with the problem of acid rain, which has damaged the lakes in New York State to the extent that much of the aquatic life in the lakes is dead.

We are concerned that the acid rain will also damage crops, and even affect the water supply of millions of people in the state.

Since this is a national problem, it is fitting that the Congress of the United States takes action. Therefore, the Waterman Bird Club strongly urges you to support the Waxman Bill.

Yours truly,

Lillian Schneier

Lillian Schneier

Conservation Chairperson

R.D. 2 Box 464
Quaker Hill Drive
Hyde Park, N.Y. 12538

emc

rockland county health complex bldg D room 173 pomona new york 10970

rockland county
environmentel
managemant
council

November 29, 1983

Statement to the Congressional Sub-Committee on Health and Environment at hearing held December 1, 1983, World Trade Center, New York, N.Y. on the subject of ACID RAIN legislation - to review the Waxman-Sikorski Acid Rain Control Bill (HR-3400).

Submitted by: - Barbara Porta, Executive Director

The Rockland County Environmental Management Council (EMC) supported the reauthorization of the Clean Air Act with provisions for strong Acid Rain legislation as an amendment to the Act, in 1981, 1982, and 1983. Letters were written to Congressman Gilman and Senators Moynihan and D'Amato urging them to vote favorably for Representative Henry Waxman's recommendations which he submitted in 1982.

For the record at this hearing, the Environmental Management Council continues to support the Waxman Bill (HR-3400) with the addition of the Ottinger amendment on further increasing sulfur dioxide reductions, and the Wirth amendment on toxic airborne pollutants control. This combined legislation would help decrease sulfur dioxide emissions into the air by approximately 50%, the amount recommended by the National Academy of Sciences, and would remove 12 million tons from the air.

Rockland County, New York lies within the New York metropolitan region where strict air quality regulations for emission control are mandated. The Lovett electrical generating plant of Orange and Rockland Utilities, is located in the Town of Stony Point at the northern edge of the Air Quality Central Region. The proposal for coal conversion of the Lovett Plant has been a source of much controversy with regard to predicted sulfur emissions and particulates, methods to control stack emissions, ash disposal, and the effects of airborne discharges on the acid rain problem. These are very serious concerns since there are potentially dozens of electric generating plants in the metropolitan region that will seek approval for coal conversion if and when the Lovett Plant receives the go-ahead to burn coal in the very near future.

The cumulative effect of sulfur dioxide emissions from coal conversion generating plants in the metropolitan region could be devastating if either air quality standards are lowered and/or the cause of acid rain remains uncontrolled. Since neither of these actions is desireable, we must look to environmentally sound measures to alleviate the problems.

The EMC would like to see a new approach in the use of coal for fuel, a front end method that burns coal cleanly and efficiently. One method suggested is fluidized-bed combustion which is claimed to reduce sulfur dioxide by 90% whether it's high-grade coal or low grade. Fluidized-bed boilers are already in use in smaller sizes, but could be made for large generators. By removing the sulfur dioxide before it reaches the stack, the 12 million ton reduction in emissions could become a reality.

telephone (914) 354-0200 ext 2537

The EMC recognizes the fact that the Acid Rain problem is not just a local issue, or just a state issue. Acid Rain has become a national and international issue with far reaching environmental and economic consequences - disastrous consequences. The 31 states east of the Mississippi for which a 50% reduction of sulfur dioxide emissions is needed, might have to be increased to include all the states if action doesn't immediately replace the Reagan Administration's plan for only 2 - 4 million tons reduction in only 4 states. We don't need more multi-million dollar research reports until we've taken more positive action to actually stop Acid Rain from forming in the first place.

During the 38th Annual Meeting of the Soil Conservation Society of America held in Hartford Connecticut last July, one of the speakers representing the Tennessee Valley Authority, graphically described the disastrous effects of acid rain on fish, animal, and plant life in the mountain streams and brooks of the Smokies and Cumberland Mountain regions of Tennessee and North Carolina. The death of thousands of fish immediately following a heavy rain, was the direct result of high acidity emanating from airborne sulfur dioxide in solution which had drifted from the stacks of TVA facilities. It was heartening to hear the speaker report that TVA has made a committment to reduce its sulfur dioxide emissions by 50%.

But there are hundreds of other industries where the sources of acid forming pollutants are being discharged daily into the atmosphere, heading airborne to be transformed, and settling somewhere else to destroy a lake or stream or fragile ecosystem.

If the dead lakes in New York's Adirondack Mountain region are the result of drift from coal burning plants in the Ohio Valley, and the drift is moving southward, can we really afford to wait for a solution to the problem? Building higher and higher stacks is not the answer, nor is the weakening of standards under the Clean Air Act. Immediate passage of strong Acid Rain legislation and immediate implementation of that legislation must be approved by the Congress. We urge all to support the Waxman-Sikorski Bill with the inclusion of the Ottinger and Wirth amendments.

Submitted by: Barbara Porta, Executive Director
Rockland County Environmental Management Council

Rockland Audubon Society, Inc.
P. O. Box 404, New City, N. Y. 10956
Organized 1947
A chapter of National Audubon Society, Inc.

STATEMENT ON ACID PRECIPITATION LEGISLATION TO BE PRESENTED TO THE CONGRESSIONAL SUB-COMMITTEE ON HEALTH AND ENVIRONMENT, NEW YORK CITY, DECEMBER 1, 1983.

The 520 members of the Rockland Audubon Society have been following the acid deposition story for eight years now and have high praise for those of you in Congress who have taken the strong stand necessary. Unfortunately, we no longer have the luxury of time that we had a decade ago: certain conditions such as the loss of buffering agents in our soils are now irreversible and further degradation will only increase the degree of irreversibility. When we could have accomplished balanced compromises, we did not. Emitters won out.

The time for compromise is over. We simply cannot afford it. The cost must be borne by all and the solution, if solution there is, must be nationwide, not piecemeal.

The Board of Directors and other members of Rockland Audubon Society support H.R. 3400 BUT it must be strengthened to mandate at least a 50% reduction in sulphur emissions. At this point in time, nothing less is acceptable.

In the face of a weakened Environmental Protection Agency, a justifiably impatient ally to the north (Canada), and an Administration whose bias is well known, environmental protection is up to you, our Congress. The implications of the acid deposition problem make it one of the most devastating and widespread of current problems--for agriculture and public health as well as for the entire ecosystem upon which we all depend.

Judith Kessler, President

Rockland Citizens for Safe Energy
P.O. Box 74
New City, New York 10956

STATEMENT IN SUPPORT OF ACID PRECIPITATION LEGISLATION BEING CONSIDERED BY THE CONGRESSIONAL SUB-COMMITTEE ON HEALTH AND ENVIRONMENT, NEW YORK CITY, DECEMBER 1, 1983.

Rockland Citizens for Safe Energy was an intervenor in the hearings on the first New York State utility to seek to convert to coal, 1981. It is our conviction that the responsibility for pollution control must be shared by all, that existing and new sources of pollution should be controlled equally. We are concerned not only about the severe environmental effects of acid precipitation, but also about the public health effects of respirable sulphate aerosols. For this reason, we sought the use of baghouse filters to control those emissions that scrubbers cannot control.

Until the baghouse technology, or others such as fluidized-bed burning, are perfected, it is essential that scrubbers be required to severely curtail emissions and the production of harmful sulphate and nitrate compounds. A 50% reduction is the very least that we should expect. Anything less would be a non-recognition of the seriousness of the problem.

We ask, then, that you support H.R. 3400 with a 50% reduction amendment. We ask that you incorporate said amendment in your committee so that such an important aspect of this legislation is not left to the compromise process. The time for compromise is past in this issue, a fact which is recognized by the many members of the public whom I address in a year. The future will only bring additional support for the strongest of legislations and condemnation for weakness. We hope that your committee will take a position of strength: its wisdom therefor will be greatly admired in future years and public support will be as strong as it now is for our landmark environmental legislation.

Thank you.

Judith Kessler
Coordinator

ROCKLAND COUNTY CONSERVATION ASSOCIATION, INC.

P.O. BOX 772 • PEARL RIVER, NEW YORK 10965

The Rockland County Conservation Association, Inc., Box 772, Pearl River, New York 10965 has, since its establishment in 1930, worked continuously and actively for a safe, healthy environment. An important thrust of this county-wide organization centers in up-coming years on toxics and their effects on the life on our planet. For this reason, this Association finds the Waxman-Sikorski Acid Rain Bill (HR-3400) of great interest and importance.

The Bill is a step in the right direction, acknowledging that there is a problem with sulfur dioxide and nitrogen oxide emissions. However, it falls far short of what the Rockland County Conservation Association feels needs to be done. Over and over, members are told that industry must not be impeded, that conservationists must not interfere with progress. Life-taking pollution is progress in reverse -- dangerous progress towards the anihilation of a variety of life forms.

Presently available is knowledge to prevent, or at least alleviate the damage being done by acid rain to our lakes and streams. Unquestionably, it will be expensive to put that knowledge to work. But expense can no longer be considered a valid excuse for allowing toxics to destroy sections of the environment. Will it be cheaper to control this destruction at a later date? Will the acid rain problem disappear if we all look the other way? Will damage be irreversible?

Rockland County Conservation Association's contention is that Bill HR-3400 must be made considerably stronger. Its members are realistic enough to understand that pollution caused by industry cannot be eliminated entirely until the knowledge of its effects and how to control them becomes more exact. Nevertheless, its members are convinced that the use of equipment which is presently available can eliminate at least 50% of the sulfur dioxide emissions caused by burning fossil fuels.

Therefore, the Rockland County Conservation Association, Inc. will support the Waxman Bill (HR 3400) if it is amended as proposed by Congressman Richard Ottinger of New York to increase the sulfur dioxide emissions reduction by 2 million tons to bring the reduction to the 50% recommended by the National Academy of Sciences.

Lois E. Jessup

Lois E. Jessup, President
Rockland County Conservation
Association, Inc.
P. O. Box 772
Pearl River, New York 10965

November 30, 1983

Natural Resources Defense Council, Inc.

122 EAST 42ND STREET
NEW YORK, N.Y. 10168
212 949-0049

Washington Office
1725 I STREET, N.W.
SUITE 600
WASHINGTON, D.C. 20006
202 223-8210

Western Office
25 KEARNY STREET
SAN FRANCISCO, CALIF. 94108
415 421-6561

November 23, 1983

Hon. Representative Henry Waxman
House of Representatives
Washington, D.C. 20515

Dear Representative Waxman:

The Natural Resources Defense Council, Inc. is pleased that you will hold a public hearing in New York City on December 1, 1983 on the important topic of acid rain, and commends you for your efforts to find a solution to acid rain problems. As a member organization of the Adirondack Council, we are especially concerned about acid rain damage in the Adirondack mountains.

The Natural Resources Defense Council, Inc. supports H.R. 3400 (the Waxman-Sikorski-Gregg Bill), but urges that the reduction goal for sulfur dioxides be increased to fifty percent in order to adequately protect the Adirondacks and other areas at risk in New York State.

Sincerely,

Lynne T. Edgerton

Lynne T. Edgerton
Senior Project Attorney

LTE:bb

New England Office: 17 ERIE DRIVE • NATICK, MA. 01760 • 617 655-2656
Public Lands Institute: 1720 RACE STREET • DENVER, CO. 80206 • 303 377-9740

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C. A. N. A. R. I.

Coalition of
Adirondackers to
Neutralize
Acid
Rain
Inflow

P. O. Box 238
Paul Smiths, NY
12970

Miners used canaries to detect the presence of deadly gases.

Dying fish in our Adirondack lakes are the "canaries in the mines," warning us of the lethal effects of acid rain.

November 28, 1983

Honorable Henry Waxman
Chairman, Subcommittee on Health and
Environment
c/o Adirondack Council
Elizabethtown, NY 12932

Dear Honorable Waxman:

CANARI, a coalition of some 120 organizations representing approximately 13,000 individuals in the Adirondack region of New York State, expresses its strong support for legislation you have introduced to control acid deposition. As you know, the Adirondacks are very sensitive to this problem and have lost several hundred bodies of water to acidification, as well as exhibiting at least a 50% death rate in high-elevation red spruce forests.

H.R. 3400 is a good beginning, but it does not go far enough to eliminate the problem here. We need at least a 12 million ton reduction in sulfur dioxide emissions, as recommended by the National Academy of Sciences. At present, nearly 43 kilograms of sulfate per hectare is deposited here annually. Most scientists feel that for poorly buffered areas like the Adirondacks, this rate of deposition needs to be reduced to below 20 kilograms per hectare. We urge you to amend the present H.R. 3400 to stipulate at least a 12 million ton reduction within 10 years.

The Adirondack Park is a 6 million acre jewel of wildness in northern New York that nearly 9 million tourists enjoy every year. They come here because of its pristine wild beauty and primeval character of mountains, lakes, wildlife, and forests. And every year, acid deposition steals a little of that wonderful quality. We need your help, through a strengthened version of H.R. 3400, to save this precious resource, now and for future generations.

Sincerely,

Mike Storey

Mike Storey
CANARI Representative

MS:pk

cc: Honorable David O'B. Martin
Senator Daniel Patrick Moynihan
Senator Alphonse D'Amato
President Ronald Reagan

POSITION STATEMENT ON ACID RAIN AND HR 3400 SUBMITTED TO THE SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT ON DECEMBER 1, 1983 BY THE ASSOCIATION FOR THE PROTECTION OF THE ADIRONDACKS (FOUNDED 1901)

This Association endorses the general principle expressed in this bill that acid precipitation is such a substantial problem that it should be addressed by the Nation as a whole. Estimates by ICF of the long term (2010) reductions in SO_2 emissions under the Stafford bill are insufficient to cure the problem and the same is likely to be the case in regard to HR 3400 as it stands today so more drastic reductions than those stipulated therein are required in the long run.

A New York DEC study on acid rain includes the results of a public opinion poll of New York State households which reveals that at least three-fourths thereof are aware of the acid rain threat and half of the households are willing to pay $25.00 per month on their utility bills to deal with the problem. Interestingly, there is little regional difference of response in regard to this financial burden. In view of the great political objections raised in the Midwest and in Washington, D. C. about the cost of reduction of emissions, we believe a similar nationwide poll would help to break the legislative log jam in Washington. We would also suggest for consideration in the legislation greater financial incentives to those utilities willing to install experimental combustion techniques such as LIMB (lime injection multiple burn) and fluidized bed boilers. We believe our suggestions would expedite action on the acid rain problem.

THE ASSOCIATION FOR THE
PROTECTION OF THE ADIRONDACKS
Bernard C. Smith, President
By Arthur M. Crocker
Arthur M. Crocker, Chairman

WEST OF THE WIND PUBLICATIONS, Inc.

Ecological Consulting — Natural History Writing and Photography — Wildlife Conservation

November 28, 1983

TESTIMONY ON ACID RAIN H.R. 3400 WAXMAN BILL

As a resident of the Adirondack Park for over 20 years, an ecologist, and a registered Adirondack guide, I have noted the many changes in the aquatic and terrestrial ecosystems caused by acid deposition recently.

In addition, research and interviews which I did to produce a National Geographic article (Nov. 1981) on acid rain -- "How Menacing Is Acid Rain?" -- convinced me this phenomenon is not merely a regional Adirondack problem, but a global one. Please see attached copy of magazine.

For these reasons I strongly support the H.R. 3400 Waxman bill. The method of spreading costs across the nation is immanently fair. Acid rain knows no borders -- it is everyone's responsibility. We all most pay for the priviledge of clean air and rain.

The one point I would change is to set emmission reductions at 12 million tons, rather than 10 million. Just last November 20th, I measured the pH falling in a heavy rainstorm. It read 3.7! Only the most stringent reductions can produce a healthy change in this already badly-damaged landscape.

I should also like to reiterate in this letter, as a Director-at-Large of the National Wildlife Federation, that our group of some 4 million members, also backs the Waxman bill.

Thank you.

Respectfully submitted,

Anne LaBastille

Anne LaBastille, Ph.D.

Attached: 1 National Geographic magazine **may be found in the subcommittee files.**

BIG MOOSE, N.Y. 13331, USA

Congressional Sub-Com.
on Health + Environment

Nov. 30, 1983

Gentlemen:

We the members of the Mamaroneck League of Women Voters would like you to know that we strongly support HR 3400 the Sikorski - Waxman - Gregg acid rain control bill. Our one hundred and seventy-two members would like to see the bill pass with the Ottinger amendment. The aforementioned would increase the bills 10 million ton sulfur dioxide emission reduction goal by 2 million tons. Acid rain poses many risks from health to forest productivity and the destruction of life. We must act now to save our future and the futures of our children!

Please help us pass this important legislation.

Sincerely,
Joan Katen
Action Chairman

LEAGUE OF WOMEN VOTERS OF LARCHMONT
LARCHMONT, NEW YORK 10538

November 29,1983

To: Congressional Sub-Committee
Health and The Environment

From: The League of Women Voters of Larchmont

Re: Waxman - Sikorski bill H.R. 3400

We are writing on behalf of our 350 League members in support of the Waxman - Sikorski bill H.R. 3400 . We also favor an amendment to increase required reduction of sulphur dioxide emissions to 12 million tons or 50%.

Mary Joyce Beringer, President
Mary Joyce Beringer
Margaret L. Strauss, Natural Resources Chmn.
Margaret L. Strauss

THE CITY OF NEW YORK
OFFICE OF THE MAYOR
NEW YORK, N.Y. 10007

January 11, 1984

Hon. Henry A. Waxman
Chairman
Subcommittee on Health and the Environment
2415 Rayburn House Office Building
Washington, D.C. 20515

Dear Henry:

On behalf of the City of New York, I would like to express my appreciation to the House Subcommittee on Health and the Environment for this opportunity to present New York City's views on federal acid rain proposals.

In recognition of the threat which acid rain poses to public health and natural resources, and the national and international dimension of the acid rain problem, New York City supports a federal approach which effectively mitigates the profound impacts of acid rain.

The City has long recognized the need -- and accepted the costs -- of controlling its own emissions of acid rain precursors. In fact, the City required SO_2 emission controls years before national SO_2 emission controls were implemented. These controls include imposition of a 0.3 percent fuel sulfur limitation, one of the most stringent fuel sulfur limitations in the nation, which has effectively precluded coal burning in the City for more than a decade.

The City's fuel sulfur limitation has been costly. In the past few years Consolidated Edison and its customers have paid an estimated sulfur premium of $3.00 per barrel to purchase 0.3% sulfur residual oil, rather than the U.S. average 1.1% sulfur oil. Given an average consumption of 24 million barrels of residual oil per year, this amounts to a representative annual surcharge of $72 million for using oil so much lower in sulfur than the U.S. average.

Even more striking is the difference between Con Edison's fuel costs and those of coal burning utilities. Con Edison's 0.3% sulfur oil costs three times as much, per million BTU, as the most expensive of low sulfur coals. Additionally, Con Edison already has made a $56 million investment in air pollution control equipment.

These differences in fuel costs have helped make Con Edison's rates among the highest in the country. The average price to Con Edison's customers is more than twice the U.S. average for investor-owned utilities, and a considerable portion of this difference is due to the high fuel costs associated with meeting environmental regulations.

In accepting this economic burden to protect air quality within and downwind of New York City, the City is placed at an economic disadvantage to some upwind areas which have far less stringent emissions limitations than we do and which, ironically, export significant levels of sulfates and nitrates to the Northeast. These areas enjoy substantial economic benefits by using high sulfur fuels, usually without scrubbing or other sulfur removal methods.

Since acid rain is a national problem the City feels that the costs of solving this problem must be shared, and that for the cost allocation formula to be equitable it must take into account the cost of emission controls which are already enforced in some areas. For this reason, the City believes that the uniform user fee on electricity generation proposed under H.R. 3400 does not acknowledge the sulfur control costs, already being borne by areas like New York City which have been addressing this problem for many years.

If a national tax on electricity is chosen as the mechanism to fund an acid rain program, New York City believes that an equitable approach would be a "sliding scale" user fee, which would tax electricity generation on a graduated rate depending on each source's total pollution emission rate (pounds of SO$_2$ per million BTUs). This approach is consistent with a "polluter pays" philosophy and represents a fair and equitable approach to recognizing the contribution that areas, such as New York City, have made for expensive emission controls already in place. Such an approach also would exempt localities from paying user fees on non-polluting, imported hydroelectric power.

I applaud your efforts in attempting to move forward a program to control acid rain deposition, and hope that the City's concerns can be addressed.

Sincerely,

Ed

Edward I. Koch
MAYOR

EIK:cmw

When you plan on coming to NYC call me & we'll have time

ENVIRONMENTAL DEFENSE FUND

RESPONSE TO COMMENTS OF DR. WILLIAM BROWN AT HEARING ON ACID RAIN

HOUSE SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT

DECEMBER 1, 1983; NEW YORK CITY

The following comments are in response to the testimony and remarks of Dr. Brown of the Hudson Institute.

1. Dr. Brown stated that acidification of lakes may be due to natural organic acids contained in soils. In fact, some lakes are naturally acid due to soil organic compounds, but these lakes are readily distinguished by their brownish coloration. Acidification by acid rain occurs to clear (uncolored) lakes due to atmospheric deposition of sulfuric and nitric acids of anthropogenic origin. The "acidified lakes" in the Adirondacks and elsewhere which are referred to in connection with acid rain are generally clearwater lakes with no large soil acid source. Their acidification by sulfur and nitrogen from the sky is demonstrated by the fact that the chemistry of these lakes is dominated by sulfuric and nitric acids, not organic acids. For example, in the spring thaw, sulfate plus nitrate concentrations, not organic acids, increase markedly compared to the concentration of neutralizing material. On the annual average, the loss of alkalinity in lakewater corresponds directly to the sulfate and nitrate present. Furthermore, the sulfur and nitrogen input from the sky balances well with the sulfur and nitrogen

passing thorugh the lakes. Thus, atmospheric deposition of sulfur and nitrogen compounds is directly responsible for acidification of clearwater lakes.

2. Dr. Brown noted that organic acids exist in soils in much higher amounts than acids deposited from the sky. Why don't these organic acids affect clearwater lakes? Because these acids are essentially unavailable to the runoff in many instances. Runoff can flow into clearwater lakes without picking up much soil acid. This point is demonstrated by the aforementioned lack of organic acid in acidified clearwater lakes and by the dominance of sulfuric and nitric acid in these lakes. The flow occurs too rapidly for organic acids to be picked up by runoff from soils. Dr. Brown indicated that western fir forests showed runoff more acid than local rainfall. Indeed, such runoff could lead to the occurence of some naturally acid bogs. But it obviously is not responsible for acidification of clearwater lakes as demonstrated by the fact that acidified clearwater lakes occur only where rainfall has a pH less than 4.6! An absolute requirement for the existence of acid clearwater lakes is the presence of intense acid rain! (in absence of mine runoff.)

3. Dr. Brown argued that a report by Everett & Associates demonstrated that sulfur in lakes is not associated with low pH. But the Everett data was shown to be irrelevant under cross examination of Ardell G. Everett in the New York State Department of Environmental Conservation hearings on Con Edison's coal conversion applications. Among other things, variations in watershed neutralizing capacity were not taken into account. Many other

more careful studies, have clearly demonstrated the link between lakewater pH and sulfate concentration.

4. Dr. Brown argued that spring thaw flow is particularly acidic due to runoff contact with acid humus and lack of contact with neutralizing underlayers. However, such a soil model would produce organic acid runoff. But, once again, thaw runoff is dominated by anthropogenic sulfuric and nitric acids, not organic acids. Once again, the soil acid explanation is incorrect.

5. Dr. Brown argued that changing land use practices increased soil acid input, causing acidified lakes. However, this general explanation has been ruled out by many investigators, e.g. E.P.A.'s Critical Assessment Review Papers, May 1983, Ch. 4. Among other inadequacies of this theory is the failure to explain the occurence of acid clearwater lakes in essentially unmanaged areas where acid rain falls; the lack of acid clear lakes in managed areas where no acid rain falls; and the problems discussed in section 1 above.

In summary, the Brown analysis, based on the Krug and Frink article, fails completely to explain the phenomenon of acidification. Atmospheric deposition of anthropogenic acids is clearly responsible for this environmental problem.

ACID RAIN CONTROL

FRIDAY, DECEMBER 9, 1983

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Health and Environment,
St. Paul, MN.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 15, State Capitol Building, St. Paul, MN, Hon. Henry A. Waxman (chairman) presiding.

Mr. Waxman. I welcome all of our guests today and those who will be participating in our hearing.

Today's hearing is being held to consider H.R. 3400, The National Acid Deposition Control Act of 1983, introduced by Congressman Gerry Sikorski and now cosponsored by over 110 Members of the House of Representatives.

Acid rain is our Nation's most devastating environmental problem. Our Nation's scientists, including the panel hand-picked by the Reagan administration, agree that there is an immediate need for a comprehensive solution. Rainfall as acidic as vinegar is falling in virtually every State, corrupting our natural resources, lakes, farmlands, and forests and eating away at our buildings, automobiles and monuments.

In addition, scientists now suspect that acid rain directly threatens health by adding poisonous metals to drinking water supplies. Some studies even suggest that acid rain may be linked to Alzheimer's disease, a form of dementia caused by degeneration of brain cells.

Although the problem transcends state borders, the Federal Government has been stymied in initiating even a limited program primarily because legitimate concerns have been raised about possible adverse employment and utility rate effects, particularly in the Midwestern States.

We will be unable to pass acid rain control legislation so long as it is synonymous with massive job losses and electric rate increases.

Yet, these concerns cannot keep us from protecting our environment. We have the responsibility of harmonizing all of the competing concerns. Mr. Sikorski's innovative bill, H.R. 3400, does this. It protects Minneosta's environmental interests while ensuring Ohio will not suffer enormous economic dislocations.

This legislation is clearly on the move in the House of Representatives. Last week, the subcommittee met in New York City where we heard from Governor Cuomo who was joined by a group of bipartisan elected officials in endorsing the bill at our hearing at the World Trade Center.

Following the hearing we had two more Congressmen from New York, both Republicans, join the over 110 cosponsors supporting the immediate enactment of this legislation.

Last week as well, support was garnered from the New England Governors. By a vote of 6 to 1, Republican and Democratic Governors approved an acid rain control program similar to our legislation.

We are also making gains in the Midwest, a region that has historically opposed any acid rain control programs. Each day additional newspapers call for elected officials to face up to the inevitable need for a reduction of sulfur emissions. Our conversations with Midwestern elected officials have convinced us that we are on the right track.

Midwestern members of Congress are beginning to recognize that H.R. 3400 is a fair and equitable way to resolve the acid rain problem.

Yesterday, a Missouri State air pollution control official for the first time admitted that pollution from power plants in Missouri was causing acid rain problems in Wisconsin and Minnesota, including the Boundry Waters Canoe Area Wilderness.

Environmental leaders in that State called for the State to endorse H.R. 3400. The fundamental premise behind this legislation—that acid rain is a national problem in need of a national solution—finds overwhelming support around the Nation.

Earlier this week public opinion pollster Lou Harris reported that the Nation is thoroughly aroused by the acid rain problem. By a 90 to 7 percent margin the American public believes that acid rain is a serious matter that needs to be addressed.

President Reagan and EPA administrator Bill Ruckelshaus seem to be hoping that regional differences will continue to stalemate and keep Congress from adopting any legislation.

But the public again is far ahead of this administration. The Harris poll reports that a large majority of the American public favors acid rain clean up costs to be paid by electricity customers nationally. We are growing more optimistic each day that we can pass acid rain legislation early next year. If we are successful in this effort much of the credit should go to Minnesota's elected officials.

Minnesota is fortunate to have outstanding representation on this issue in the Congress. In the Senate, Senator David Durenberger has been an active participant in the acid rain debate, and perhaps no House member has worked as hard and contributed as much as Gerry Sikorski. Even though Gerry has been in the House for less than a year he has become a leader in the Congress on acid rain legislation.

This morning our subcommittee is privileged to hear from Senator Gaylord Nelson, who was an outstanding leader on environmental matters in the U.S. Senate before becoming chairman of the Wilderness Society where he has again been at the forefront of environmental matters in this country. We will also hear from Minnesota Lieutenant Governor Marlene Johnson, who will give us the State's perspective concerning the need for national legislation, and a panel of witnesses representing environmental, public health, tourism, sporting and utility interests here in Minnesota.

Before we recognize our witnesses to come and give us their views I would like to call on our colleague, Mr. Sikorski for some opening comments.

Mr. SIKORSKI. Thank you, Mr. Chairman, and thank you for bringing this hearing to Minnesota and for allowing me to fully participate in our subcommittee's efforts to control acid rain.

I have been honored to work with many fine people in Government. Some of them are here today as members of the Agricultural Natural Resources Committee of the State Senate, Charlie Berg, Donald Storm, Joe Bertrum, and Dennis Frederickson. Thank you for coming.

I have to tell everyone that one of the most impressive people I have had the honor of working with in my public career is here today in Minnesota and it is a rare privilege to have him here. Henry Waxman is one of the finest legislators in America and a chairman of a subcommittee that affects the lives personally, the resources, both economic and natural, of our country. He has been a steward of those resources throughout his career in Washington.

I want to welcome him to Minnesota, the Land of 10,000 Lakes, and hopefully as a result of our efforts this coming year Minnesota's lakes will continue to be some of the most beautiful waterways in the entire North American continent.

As we know, acid rain threatens to make our planet unlivable, perhaps not for us but for future generations. So it is particularly appropriate that this hearing is being held in Minnesota. For too long the whole acid rain debate has construed the problem as an Eastern one and the solution an industrial Midwestern one.

But as we will hear today, up to 2,000 lakes in Minnesota are threatened by acid rain. Over 3.5 million acres of our farmland or recreational forest areas are sensitive to acid rain. This area includes 85 percent of our sport fishing lakes. Sport fishing in Minnesota produces over a half a billion dollars for our economy, and provides thousands of jobs. We hope it will produce by 1995, $1.6 billion to the Minnesota economy. The Department of Natural Resources has provided us with some examples of Atlantic Salmon, not something common to the average Minnesota fisherman and woman, but something found in Northeastern Minnesota. There are very, very sensitive to changes in acidity. We now know that the streams and lakes emptying into Lake Superior are very acidified at this point because of acid rain, threaten to wipe out the species. Behind me is a map with an overlay of those areas with better than average sport fishing, and high sensitivity to acid rain. You can see that about 85 percent of the areas that we use for sport fishing in Minnesota are sensitive to acid rain. Beyond that the fish that we seek out, the Walleyes, the Northerns, the special game fish are the ones most sensitive to acid rain. Beyond that, we know that the Boundary Waters Canoe Area and the Voyager's Park area are two major sources of tourist dollars in Minnesota, yet they only represent 5 percent of the tourist dollar. One study done for the Minnesota Pollution Control Agency shows that if there were some indication of fish loss in just a few lakes in the BWCA, that area would undergo a $40 million annual loss and

3,000 job loss. That's just in the BWCA alone. Total tourism dollar is represented by about $2.4 billion in our economy and about 105,000 full-time jobs. Beyond that, agriculture counts for the number one industry in Minnesota, over 40 percent. Direct effects on crops in the form of damaged to foilage are a great concern to scientists. We have seen observable damage to leaves and protective membranes. The crops suffering appreciable damage, ironically for us in Minnesota, are two major cash crops, soybeans and corn. We know from field tests and from lab tests that acid rain reduces yield in corn by 9 percent and soybeans by 3 to 11 percent. A 1-percent reduction in yield means $50 million loss in annual revenues for the State economy. Also, a group of scientists reported to the White House Office of Science and Technology the particular concern about the damage to soil microbes or microorganisms caused by acidification. Soil microbes at the bottom of the biological cycle, they play an important role in maintaining the food chain and are very sensitive to acid rain. Our Minnesota forest products industry is also a significant contributor to our economy, yet, acid rain is doubly dangerous. It burns the leaves. It soaks into the ground, destroys the tiny root system, and starves the tree, as well as frees up toxic minerals and other elements that can invade the plant. We know in Germany they have lost over 1 million acres of their beautiful forests. Der Spiegel had a recent article about it. On the front page they had in German, "Acid Rain Over Germany, the Forest is Dying." In Norway they have lost half of the fish in the lakes affected by acid rain and that is their number one industry. In Sweden they have lost over 18,000 lakes. We in Minnesota pride ourselves about our Scandanavian and German heritage. I hope we can learn from our relatives abroad before it happens to us in Minnesota. Acid rain has been called the most serious environmental threat to the Northern American continent in this century. It also is a threat to taxpayers. The National Academy of Scientists a couple of years ago said that in the Eastern part of the United States alone, damage to public buildings and roads and surfaces and beautiful monuments, including the Statute of Liberty that we visited last week, is $5 billion on an annual basis. And finally, the most disturbing evidence scientists recently turned up is that acid rain may be linked to several forms of human brain degeneration and the cause of over 50,000 premature deaths annually in the United States. Last week the subcommittee heard testimony in New York that frightened me. Parts of New York affected by acid rain have advised residents to flush their drinking water lines before they drink from them to eliminate toxic chemicals from that drinking water. So it is no wonder that acid rain has been called a chemical lepracy creating a sewer in the sky. That is why I joined with Chairman Waxman in introducing H.R. 3400, the only national acid rain control legislation that responds to a national problem as a national problem. It spreads the cost of clean up so no region is burdened by skyrocketing utility rates. And, finally, it saves a quarter of a million jobs. It would add a fee to the average Minnesota rate payer about a dollar a month. But the money collected would pay 90 percent of the one time cost of installation of scrubbers in the 50 dirtiest powerplants in this country. Now, in contrast, some have suggested an emissions tax plan that would be levied against consumers of cars and trucks and other durable goods and electricity. While in theory this approach should save Minnesotan consumers money, the Independent Office of Technology Assessment has documented the difference is purely negligible. For example, Minnesota utility rates would increase by 41 cents per month under Senator Durenberger's emissions tax scheme and 50 cents under the 1 mil theme proposed in H.R. 3400. Besides that, Minnesota consumers under an emissions tax plan would have to pay even more for cars and trucks and other manufactured goods, and Minnesota jobs, specifically on the iron range, could be jeopardized under such a scheme. More importantly, while this Tax the polluters—we have done our job, let the other people clean up, concept sounds good in theory, in practical terms it is unenforcable, costly and politically means we will have no acid rain control legislation in America. Minnesota would likely remain unprotected under such a scheme, even though Minnesota consumers would pay an emissions tax. Two weeks ago over 100 million Americans watched the program "The Day After" on TV. We watched the once beautiful American landscape destroyed overnight, turned into wasteland. If this hearing were being held in northern Minnesota, besides being very cold, I could show you a slower but just as devastating transformation. The beautiful pristine wilderness areas of Minnesota are fast becoming the site of fishless lakes and thinning forests. This is a tragedy we can and must avoid. Mr. Chairman, thank you for your leadership on behalf of a clean and healthy and beautiful America. And thank you for coming here, even though I promised you there wouldn't be any snow and it would be kind of warm and the airport wouldn't have been closed down.

Mr. WAXMAN. Thank you very much, Mr. Sikorski. The airport was not closed down. That was the only part of your promise that——

Mr. SIKORSKI. I have one presentation, Mr. Chairman, at this point. As a token of our appreciation we wanted to give you these Boundary Waters earmuffs with the buttons that say, "Stop Acid Rain". I will model them first for you. They go like this.

Mr. WAXMAN. They don't wear those in Los Angeles unless you are trying to drown out some rock music. Thank you very much. I am very pleased to receive this. I might also mention I once received from the environmentalists an umbrella that says, "Stop Acid Rain". Some of you may have that very same umbrella. I warn you, however, don't use it in the rain. It leaks.

I want to acknowledge the presence of Senators Fredrickson, Bertrum, Storm and Berg. We are pleased to have them with us at this meeting.

Our first witness is a very distinguished former member of the U.S. Senate, a man who needs really no introduction to any of us who have looked at environmental concerns. The Honorable Gaylord Nelson, who is chairman of the Wilderness Society.

STATEMENT OF GAYLORD NELSON, CHAIRMAN, THE WILDERNESS SOCIETY

Mr. Nelson. Mr. Chairman, Congressman Sikorski, first let me say that everyone who has been—who is concerned about the major problem of acid rain wants to thank the Chair and Congressman Sikorski for what the prestigious National Journal has called the most innovative acid rain control bill introduced in either house of the Congress. I am chairman of the Wilderness Society. And the Wilderness Society is a member of the National Clean Air Coalition which is composed of more than two dozen national environmental health, labor, and civic organizations. The Wilderness Society and the National Clean Air Coalition consider acid rain to be the most pressing environmental threat to our Nation today, and action we believe needed now to stop acid rain from doing more damage to the fragile environments of the upper Midwestern States and vulnerable areas across the entire country. I know that you are limited on time because of the number of witnesses that you have. So I will read some excerpts from my testimony and ask that the balance, which is too long to read——

Mr. Waxman. Without objection your full statement will be made part of the record.

Mr. Nelson. Indeed, the potential economic and environmental damage from acid rain, if unabated, is monumental by any standards of measurement. It threatens the productivity of our forests and agricultural lands. It threatens the integrity of all of our fresh water assets and will ultimately sterilize and destroy the productivity of a great portion of our marshes, lakes, rivers, and streams. As that happens we will witness the decline and disappearance from these waters of ducks, geese, and all other birds and mammals whose survival depends upon a productive acquatic environment. No one can put a dollar sign on the beauty, sense of wonder, inspiration, enjoyment and pleasure these creatures bring to the habitat where we all live together in one vast ecosystem. Economics is important too. In this case the economics is on the side of the birds, wild animals, and fresh water. It will be far cheaper, far cheaper in dollars and more profitable to prevent the economic damage of acid rain than to pay its annual costs, which we are already doing, and that cost is escalating each and every year. As Congressman Sikorski mentioned, the National Academy of Science estimates current yearly economic damage, not environmental, economic damage in the Eastern United States equals $5 billion. That is much more than the annual cost of any of a dozen acid rain bills pending in the Congress. Acid rain is a national problem that requires a national sollution. Congress now appears ready to reject the do more research and pray approach for legislative action that meets the acid rain problem head on by significantly reducing the emissions of sulfur and nitrogen oxides. While these hearings and further discussions and analysis is likely to produce some good ideas for fine tuning this legislation, H.R. 3400 is a sound concept. Just as important, it is politically feasible. It serves no useful purpose to advocate a sollution in a vacuum. The bill is carefully crafted to transcend regional concerns. It accomplishes what the Ruckelshaus EPA and the Reagan Cabinet Counsel have failed to do. It offers environmental protection to areas that need it, and through a carefully balanced control strategy, it affords economic protection for electricity consumers and job protection for coal miners in the Ohio Valley. With the addition of an amendment to increase overall sulfur dioxide reductions to the 50 percent suggested by the National Academy of Sciences, H.R. 3400 would be a complete program of acid rain control. In its current form it represents a major commitment on the part of its sponsors to offer the leadership necessary to fashion a solution to the acid rain problem and to guide it through the political process. Last May President Reagan asked the Environmental Protection Administrator Ruckelshaus to devote his energies to develop a solution to the acid rain problem. Those of us who have been frustrated for quite some time by the Administration's position that acid rain needed more study saw in this suggestion by the President to Mr. Ruckelshaus as a ray of hope. However, Administration opposition to acid rain controls has apparently been transformed into nothing more than Administration stalling on this issue. EPA Administrator, Ruckelshaus, suggested recently that the Administration would not develop a position until one became necessary for political reasons. President Reagan has abandoned his national responsibility on acid rain. At the White House acid rain apparently is not thought of as a serious environmental problem, but a mere political irritant to be smoothed over when election year strategy dictates. The Administration is apparently prepared to recommend only a limited band aid acid rain control plan which would put off any meaningful protection for Michigan, Minnesota, and Wisconsin into the next century. And even this so-called program is stalled in the White House Cabinet Council where David Stockman apparently sets environmental policy.

Mr. Stockman, you will recall, learned somewhat late in 1981 of 170, at around that lakes, whose fishs' life has been killed by acid rain. Mr. Stockman thought, only to ask, how much are fish worth?

Mr. Stockman has since attempted to ridicule the problem by assuming that the only benefit from acid rain control comes from repairing the lakes for these new fish.

I want to take this opportunity to broaden the horizon a little bit. The Office of Technology Assessment estimates that 9,000 lakes and 61,000 miles of streams in the Eastern United States are threatened today with acid rain damage. This total represents 53 percent of the lakes and 52 percent of the streams in sensitive areas of 23 Eastern States. Damage to soil and forests from acid rain have such an alarming potential that even the President's own science office recently acknowledged its concern and urged an immediate program of abatement. The Wilderness Society Economic Policy Department has examined the research data on the economic impact of acid rain damage to crops and forests. That data indicates that annual corn and soy bean losses could total $1 to $2 billion. Timber losses could total 330 to 600 million board feet per year. And every year we delay the cost mounts. More lakes are damaged, more forests potential is lost. More of our historical heritage literally dissolves from the impact of acid rain. Closer to home, here in Minnesota, we know that acid rain threatens 25 percent, or as many as 2,500 of the fresh water lakes in this State. According to Minnesota Pollution Control Agency, even the first signs of acidification would result in a loss of 40 million per year in revenues and up to 3,000 jobs in the Boundry Waters Canoe Area. In Wisconsin the picture is no less serious. More than 80 percent of Wisconsin lakes are in the northern part of the State, and an area especially sensitive to acid rain. With 2,000 lakes likely to be damaged at current rates of acid deposition, according to the Wisconsin Department of Natural Resources, the economic impact on the $6 billion tourism industry, and $500 million sports fishing industry could be disastrous. In Michigan's Upper Peninsula, nine lakes have already been acidified and more are threatened. Tourism, commercial forestry, and agriculture are the lifeblood of the economies of Minnesota, Wisconsin, and Michigan, and all of these States have started to take action by writing stricter laws to curtail acid rain. But the sollution demands controls beyond the borders of the Midwest and H.R. 3400 addresses the issue with a national concept that is practical politically, workable, and effective. Thank you, Mr. Chairman.

[Prepared statement of Mr. Nelson follows:]

THE WILDERNESS SOCIETY

GAYLORD NELSON
CHAIRMAN

STATEMENT OF GAYLORD NELSON, CHAIRMAN, THE WILDERNESS SOCIETY, BEFORE THE SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT OF THE U.S. HOUSE OF REPRESENTATIVES, AT THE DECEMBER 9, 1983 ACID RAIN CONTROL HEARINGS, MINNEAPOLIS, MINNESOTA.

I am Gaylord Nelson, Chairman of The Wilderness Society. The Wilderness Society is a member of the National Clean Air Coalition which is composed of more than two dozen national environmental, health, labor and civic organizations. The Wilderness Society and the National Clean Air Coalition consider acid rain to be one of the most pressing environmental threats facing our nation today. Action is needed now to stop acid rain from doing more damage to the fragile environments of the upper Midwestern states and vulnerable areas across virtually the entire U.S.

Indeed, the potential economic and environmental damage from acid rain, if unabated, is monumental by any standard of measurement. It threatens the productivity of our forests and agricultural crops. It threatens the integrity of all of our fresh water assets and will, ultimately, sterilize and destroy the productivity of a great portion of our marshes, lakes, rivers and streams. As that happens we will witness the decline and disappearance from these waters of the ducks, geese and all other birds and mammals whose survival depends upon a productive aquatic environment. No one can put a dollar sign on the beauty, sense of wonder, inspiration, enjoyment and pleasure these creatures bring to the habitat where we all live together in one vast ecosystem.

Economics is important, too, and in this case the economics is on the side of the birds, wild animals and fresh water. It will be far cheaper in dollars, far more profitable to prevent the economic damage of acid rain than to pay its annual cost which we are already doing and the cost is escalating each and every year. The National Academy of Science estimates current yearly economic damage in the Eastern United States equals 5 billion dollars. That is much more than the annual cost of any of a dozen acid rain bills pending in the Congress.

Acid rain is a national problem that demands a national solution. Congress appears ready to reject the "do more research and pray" approach for legislative action that meets the acid rain problem head on by significantly reducing emissions of sulphur and nitrogen oxides.

While these hearings and further discussion and analysis is likely to produce some good ideas for fine tuning this legislation, H.R. 3400 is sound in concept. Just as important, it is politically feasible. It serves no useful purpose to advocate a solution in a vacuum. The bill is carefully crafted to transcend regional concerns. It accomplishes what the Ruckelshaus EPA and Reagan Cabinet Council have failed to do. It offers environmental protection to areas that need it, and through a carefully balanced control strategy it affords economic protection for electricity consumers and job protection for coal miners in the Ohio Valley. With the addition of an amendment to increase overall sulfur dioxide reductions to the 50% suggested by the National Academy of Sciences, H.R. 3400 would be a complete program of acid rain control.

In its current form, it represents a major commitment on the part of its sponsors to offer the leadership necessary to fashion a solution to acid rain, and to guide it through the political process.

Last May, President Reagan asked Environmental Protection Agency Administrator Ruckelshaus to devote his energies to developing a solution for acid rain. Those of us who were frustrated by the Administration's earlier position that acid rain needed more study saw a ray of hope. However, Administration opposition to acid rain controls has apparently been transformed to nothing more than Administration stalling on this issue. EPA Administrator Ruckelshaus suggested recently that the Administration would not develop a position until one became necessary for political reasons.

President Reagan has abandoned his national responsibility on acid rain. At the Reagan White House, acid rain apparently is not thought of as a serious environmental problem, but a mere political irritant, to be smoothed over when election year strategy dictates.

The Administration is apparently prepared to recommend only a limited band-aid acid rain control plan which would put off any meaningful protection for Michigan, Minnesota and Wisconsin into the next century. And even this so-called program is stalled in the White House Cabinet Council, where David Stockman apparently sets environmental policy. Mr. Stockman, you recall, learned in 1981 of 170 Adirondack lakes whose fish life was killed by acid rain. Mr. Stockman thought only to ask, "how much are the fish worth?"

Mr. Stockman has since attempted to ridicule the problem by assuming that the only benefit from acid rain control comes from repairing the lakes for these few fish. I want to take this opportunity to broaden his horizons a bit.

The Office of Technology Assessment estimates that 9,000 lakes and 61,000 miles of streams in the Eastern U.S. are threatened -- today -- with acid rain damage. This total represents 53% of the lakes and 52% of the streams in sensitive areas of 23 eastern states.

Damage to soil and forests from acid rain has such alarming potential that even the President's own science office recently acknowledged its concern. On the high elevations of Vermont's Camels Hump mountain, a 41% reduction in biomass has occured between 1965 and 1983. At lower elevations, biomass has decreased 19% to 12% in the same period. Red spruce and mountain maple are most severely affected.

The Wilderness Society has examined the research data on the economic impact of acid rain damage to crops and forests. That data indicates that annual corn and soybean losses could total $1 to $2 billion; timber losses could total 330 to 660 million board feet.

Visibility impairment -- mainly from the precursors of acid rain, sulfates -- has increased by 10 to 40% over the past 25 years.

Human health risks, both direct and indirect, are significant. The Office of Technology Assessment estimates that the inhalation of sulfates may cause 50,000 excess deaths every year. Recent studies indicate that acid rain is leaching dangerous metals, such as lead, cadmium, and copper, from drinking water pipes, and metals, such as aluminum and mercury, from watersheds unable to buffer acids.

And every year we delay, the cost mounts -- more lakes damaged; more forest growth potential is lost; more of our historical heritage literally dissolves from the impact of acid rain.

Closer to home, here in Minnesota, we know that acid rain threatens 25%, or as many as 2,500, of our great fishing lakes. According to the

Minnesota Pollution Control Agency, even the first sign of acidification would result in a loss of $40 million per year in revenues and up to 3000 jobs in the Boundary Waters Canoe Area.

In Wisconsin the picture is no less frightening. More than 80% of Wisconsin's 15,000 lakes are in the northern part of the state, an area especially sensitive to acid rain. With 2000 lakes likely to be damaged at current rates of acid deposition, according to the Wisconsin Department of Natural Resources, the economic impact on the $6 billion tourism industry and $500 million sport fishing industry could be disastrous. And in Michigan's Upper Peninsula, nine lakes have already been acidified and more are threatened.

Tourism, commercial forestry and agriculture are the lifeblood of the economies of Minnesota, Wisconsin, and Michigan. All three states have started to take action by writing stricter laws to curtail acid rain. But the solution demands controls beyond the borders of the upper Midwest.

The time has come to put in place a major emissions control program. In 1981, the National Academy of Sciences recommended that the acidity of rainfall be cut by 50%. In their follow-up report of 1983, the Academy found that reducing SO_2 emissions would result in directly proportional cuts in acid rain. The Academy also found that the pollution contributing to acid rain is throughly mixed over huge areas. The conclusion is thus inescapable: a full 50% reduction in sulfur dioxide emissions is needed to protect sensitive areas, especially in the eastern states. We are asking that Congress adopt a control program that achieves this 50% reduction within the next 10 years and sooner if possible.

Congress has made important strides toward this end over the last two years. However, Congress must not allow another year to pass without enacting a comprehensive acid rain control program. This program will cost less than the annual damage caused by acid rain, and it should be set in motion in 1984.

Ohio -- the number one emitter of sulfur dioxide in the country -- Indiana, Illinois, and Missouri and many other states will have to make major cuts in their sulfur dioxide pollution to protect the upper Midwest and other vulnerable areas from further damage. That fact is inescapable.

Opponents of controls have made wildly inflated cost and job loss claims. But the cost of control is not unduly burdensome, as numerous studies have demonstrated. H.R. 3400 will keep electricity rates down in all states and prevent shifts away from high sulfur coal production.

A major argument of the opponents to acid rain controls is that electricity rates will spiral. Under H.R. 3400, average rate increases in the Eastern U.S. will be 3.4% to 4.0% during the most expensive part of the program. Even in the states with the largest cleanup obligations, electric bills will continue to be lower than rates in many of the states currently being damaged by acid rain. H.R. 3400 offers help to states which have been opposing acid rain control. Under H.R. 3400 the most polluting states will be asked to assume most of their cleanup costs but not all of the costs.

Under H.R. 3400, concerns of high sulfur coal producing communities are addressed. First, SO_2 control equipment is required on 50 of the top SO_2 polluters. This will allow these 50 huge power plants to do their share of the acid rain cleanup without affecting their current coal use pattern. Their plants will continue to provide a market for 60% of the country's high sulfur coal production. Secondly, new power plants coming on line, and already required by law to use scrubbers, are expected to take up any slack in high and medium sulfur coal use. In fact, projections show that H.R. 3400 will actually stimulate increases in coal production in the states of Ohio, Indiana, and Illinois.

Across the country, coal production is expected to increase from 830 million tons to 1.3 billion by 1995, with or without H.R. 3400. Coal production in the East is expected to increase from 580 million tons in 1980 to 700 million tons in 1995 with H.R. 3400. Therefore, the arguments that acid rain controls will damage the coal industry in the East and across the country are clearly unfounded.

Congressman Sikorski, Waxman, and Gregg should all be commended for the fine balance which H.R. 3400 strikes. The bill now has more than 100 cosponsors and has sparked more interest in the House than any other acid rain bill. It is an excellent beginning.

We would like to see the bill amended to increase total SO_2 reductions from 10 to 12 million tons, a 50% reduction. The bill must achieve the environmental goal of protecting against acid rain damage in highly sensitive states such as Minnesota, Wisconsin and Michigan and in states such as New York and Pennsylvania which have suffered from environmental degradation already.

Congress has done well over the last two years. In 1982, public opinion polls, election year politics, and the critical work of key members of the Energy and Commerce Committee turned the tides in the reauthorization of the Clean Air Act. But today the threat that clean air supporters must fight is Congressional inaction. In 1984

Congressional inaction is a vote against clean air -- a vote against controlling acid rain and toxic pollutants.

This Administration and opponents of acid rain controls claim the issue is mired in regional sectionalism. This is false as recent polls by Lou Harris demonstrate. On December 4, Mr. Harris released the results of his organization's latest poll on environmental issues. A large 73-22% majority of Americans think it is fair for the costs of acid rain controls to be shared among all individuals and businesses who use fuels that contribute to the acid rain problem. And this sentiment prevails in each region of the country. Here are the Harris poll results on this question by region:

East	73-23%
Midwest	78-17%
South	71-23%
West	71-24%

Last year, the Senate Environment Committee voted 15 to 1 in favor of acid rain control; but the legislation died with the conclusion of the 97th Congress. The Senate Committee appears ready to act quickly on acid rain in 1984. We urge the Energy and Commerce Committee to initiate early work sessions aimed at bringing responsible acid rain legislation to the House floor by spring. Traditionally, spring is a time of hope. In areas threatened by acid rain, spring now brings with it the threat of death to fishlife from a snowpack in which deadly acids accumulate. For both reasons, I hope the Committee will use this spring as its symbol and its target for action.

Mr. Waxman. Thank you very much, Senator Nelson. I appreciated your making the point that the damage that we are seeing from acid rain is going to be irreversible, and if we don't put something in place now to start controlling the source of acid rain we are going to see many decades go by and the problem will be far more expensive to deal with later on. The economic figures are astounding when we realize that the cost to the economy of this country is $5 billion and maybe $6 billion a year, far less than the cost of implementing a control program so that we can stop further damage to our natural resources. Thank you very much for that testimony. Mr. Sikorski.

Mr. Sikorski. I just want to compliment Mr. Nelson.

Mr. Nelson. We will wait for that then. Go ahead.

Mr. Sikorski. We can always wait for the compliments. In my district and from my home I look at an example of bad economics, bad environmental policy. A powerplant that you fought single-handedly, I might add, to stop. I am glad to see that you are still in there fighting and I compliment you for the excellent testimony, as well as leadership role you have provided for all of us on the national level in environmental areas, especially acid rain. Thank you.

Mr. Nelson. Just one point on the argument that is constantly raised, and several times by Mr. Ruckelshaus, that we always have to make a judgment about the cost benefit ratio. In other words, can we afford to tackle this problem or any other problem; is there a benefit equal to the cost? One major thing they always overlook is that they don't factor into the cost the cost to the Nation of the loss of—the loss of a freshwater lake. How do you put a dollar sign on the loss of a productive trout stream, the loss of a productive river, the loss of a productive marsh, which sustains a great mixture of wildlife, or if we continue to pollute and destroy the productivity of the rivers and ultimately the estuaries where the rivers run into the oceans where most of the productivity is, what is the cost of the loss of the protein productivity of those estuaries? Those factors are never brought in without alone giving consideration to the question of what is the loss to us as a society from the beauty and pleasure of a wonderful environment. So it isn't just, does it cost *x* billions of dollars and can we afford to do it? The fact of the matter is the damage from not doing it will be so great that society can never pay the cost. Thank you very much.

Mr. Waxman. Thank you very much for your testimony. Since this is a meeting of the Congress of the United States, let me admonish the audience, even if you agree with the speaker, please not to demonstrate your point of view. Because if you disagree with another speaker, the logical result might be to demonstrate that as well. That breaks up the decorum of the meeting.

We have as our next witness the Lieutenant Governor of the State. We are very pleased that she is able to be with us, the Very Honorable Marlene Johnson. As she comes forward I want to acknowledge the presence of Representative Willard Menger, who is the lead environmentalist in the House here in Minnesota. Lieutenant Governor Johnson, we know of your leadership in this area. You are accompanied by Sandra Gardebring, who is the director of the Minnesota Pollution Control Agency. We are pleased to have you here with us.

STATEMENT OF MARLENE JOHNSON, LIEUTENANT GOVERNOR, STATE OF MINNESOTA, ACCOMPANIED BY SANDRA GARDEBRING, DIRECTOR, MINNESOTA POLLUTION CONTROL AGENCY

Ms. JOHNSON. Good morning, Mr. Chairman and Representative Sikorski. I want to thank both of you for the opportunity to provide the committee with the State of Minnesota's views and concerns regarding acid deposition control legislation. We particularly appreciate Representative Sikorski's leadership on acid deposition legislation in the U.S. Congress, and we appreciate Chairman Waxman, that he has taken the opportunity to come here to Minnesota to convene this important hearing. As you know, acid deposition is a great concern to Minnesotans. Due to the glacial and geologic history of Minnesota, much of northern and eastern Minnesota is sensitive to acid deposition. As the glaciers passed back and forth over Minnesota, they left thousands of lakes. But the glaciers, through their scouring action, also left very thin soils and exposed bedrock, both of which have low capacities to neutralize acid deposition. Altogether, we believe that about 15 percent, or almost 8 million acres of Minnesota's forests, peat lands, and watersheds are sensitive to acid deposition, including 1,500 to 2,500 lakes. The attachment to my testimony is a map of the sensitive and potentially sensitive areas of Minnesota. These areas cover much of eastern and northeastern Minnesota, and include the Voyaguers National Park, the Superior National Forest, the 1-million-acre Boundary Waters Canoe Area Wilderness and also include some park and forested areas in the Twin Cities. Agriculture, tourism, and forestry, are the three largest industries in Minnesota. Two of these industries, tourism and forestry, are seriously threatened by acid rain. Agriculture, though not currently threatened, could be affected if rainfall becomes more acidic in the future. As far as tourism is concerned, one study shows that the first signs of lake acidification in the BWCA could result in an annual loss of $40 million a year and 3,000 jobs. That represents only a fraction of our total tourism and sport fishing industry in Minnesota. We are very proud of our beautiful environment in Minnesota, the lakes, the forest, the Voyaguers National Park and the Boundary Waters Canoe Area. So acid deposition is an economic and environmental and emotional issue to our people. Unfortunately, the rain is most acidic in the areas that are most sensitive. So far there are no dead lakes in Minnesota. However, based on the Scandanavian experience, the acidity of precipitation and the rates of deposition in northeastern Minnesota is already great enough to begin causing subtle chemical changes in our most sensitive resources.

Minnesotans recognize that our own emissions contribute significantly to acid deposition in our State. So as a result of environmental concerns and the responsible action of industry, emissions of sulfur dioxide in Minnesota are much lower today then they were 10 years ago.

We intend to reduce emissions even further through implementation of the Minnesota Acid Deposition Control Act of 1982, the first legislation in the country to regulate acid deposition.

As far as Federal action is concerned, Minnesotans are frustrated with the sluggish reactions of Congress and the Federal Government. We are naturally concerned that any Federal legislation address acid deposition in such a manner that will ensure adequate protection for Minnesota's sensitive resources. The steps necessary to control acid deposition in Minnesota are similar, but at the same time geographically different than those necessary to control acid deposition in New England and New York. This is because the sources that contribute the most to acid deposition in Minnesota are different than the sources that contribute the most to deposition in New England. Different sources contribute to acid deposition in the Western States and the Southeastern States as well. The following concepts that we will present strive to address the geography of acid deposition equitably and in such a manner that will protect our resource.

First, an interim freeze, or cap, on total U.S. emissions of sulfur dioxide from major sources, those sources greater than 100 tons a year, should be initiated to insure that emissions of sulfur dioxide do not increase until a Federal control plan or legislation is enacted. This action is needed to prevent exacerbation of the acid deposition problem in areas that are already being affected. Such a cap could be applied on a statewide basis to allow the State flexibility in accommodating future growth in a manner that best suits each State.

Second, again, to help accommodate future growth, all major new sources should be required to employ the best available control technology, which is an existing requirement of the Clean Air Act.

Third, current research indicates that sulfur dioxide is the pollutant that is primarily responsible for long-term acidification of the environment in much of the United States. Because more is understood about the affects of sulfur dioxide on the environment, legislation should be primarily addressed to sulfur dioxide at this time. However, we do recognize the concerns about other pollutants' contribution to the problem and believe that legislation should not exclude control of other pollutants, particularly as more is learned about other contributions.

Fourth, all States should be included in Federal acid deposition control legislation. Acid deposition is not just an Eastern U.S. problem. Sensitive resources exist in the Northeast, the Southeast, the upper Midwest, and throughout the mountains of the West. Unfortunately, rainfall is acidic in many of these areas. Sources of sulfur dioxide and acid deposition exist in every State. Therefore, every State should have protection from acid deposition and every State's sources of acid deposition should be considered for control. A bill that is drafted solely to reduce acid deposition in New England may not significantly reduce acid deposition in the upper Midwest or the Rocky Mountains.

Fifth, to adequately protect sensitive resources in the United States and Canada, a reduction in sulfur dioxide emissions on the order of 50 percent is warranted. This represents a reduction of 10 to 12 million tons a year in the United States. Emission reductions can be allocated in a number of ways. A method of allocation should take into consideration existing emission levels and emission rates, so as to credit States that already employ emission controls.

Sixth, strengthening language must be added to the existing provisions for interstate transport of pollutants in the Clean Air Act. Current interstate transport provisions do not recognize acid deposition as a form of pollution. Sections 110 and 126 must be strengthened to ensure that one State is prevented from emitting air pollution which could endanger public health or welfare in another State, regardless of the violations of ambient standards. Modification of these sections of the act becomes even more important if this legislation is not applied to all States. I now will offer some specific comments related to H.R. 3400.

First, since it does not contain provisions for a cap on emissions, we support additional reductions beyond 10 million tons per year to address the concerns of future growth in emissions. A 12-million-ton-per-year reduction, for example, will help offset future growth.

Second, the allocation of emmission reductions among the States should be revised to reflect current emission rates, or in other words, the current degree of pollution control in individual States.

Third, the trading of emission reductions between States should be limited geographically, so that the reductions are achieved within the same geographic region.

Finally, I would like to comment on the concept of a funding mechanism for the purpose of assisting in mitigating the costs of complying with the Control Act. Most current legislation that controls air and water pollution revolves around the concept that the polluter should bear the cost of pollution control. Ideally, that concept should work for acid deposition as well. Therefore, we prefer no funding mechanism for acid deposition control. However, we also recognize the necessity of developing legislation that is politically acceptable to Congress in order to achieve our goal of mitigating acid deposition in a timely manner. A funding mechanism may indeed be necessary in order to meet that goal. If some type of a funding mechanism is to be added, we prefer one that recognizes, to some extent, the existing degree of pollution control in a State. H.R. 3400 establishes one type of mechanism. Many others have been proposed as well. The most important issue to the Minnesotans is reducing acid deposition. Therefore, we support whatever type of funding is required to move legislation through Congress. The benefits of controlling acid deposition will more than offset the costs of funding the reduction of sulfur dioxide emissions. We believe that strong acid rain legislation must be passed by Congress in 1984. Your bill, H.R. 3400, is the most viable bill under consideration in the House. We support it and your efforts to solve this critical environmental problem. Again, thank you for the opportunity to be here this morning to discuss this important issue. Director Gardebring will be happy to respond to questions if you like.

[Ms. Johnson's prepared statement follows:]

Testimony of

THE HONORABLE
MARLENE JOHNSON

Lieutenant Governor

STATE OF MINNESOTA

before the

HOUSE SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT
HEARING ON ACID RAIN

December 9, 1983

Good Morning, Mr. Chairman and Representative Sikorski, I want to thank you for this opportunity to provide the committee with the State of Minnesota's views and concerns regarding acid deposition control legislation. Representative Sikorski, I am very pleased that you, as a Minnesota Congressman, have taken a leading role on the acid deposition legislation in the United States House. I am also pleased that Chairman Waxman has taken this opportunity to come to Minnesota and convene this important hearing.

As you know, acid deposition is of great concern to Minnesotans. Due to the glacial and geologic history of Minnesota, much of northern and eastern Minnesota is sensitive to acid deposition. As the glaciers passed back and forth over Minnesota, they left thousands of lakes. But the glaciers, through their scouring action, also left very thin soils and exposed bedrock, both of which have low capacities to neutralize acid deposition.

Our studies at the Minnesota Pollution Control Agency (MPCA) and the Department of Natural Resources have resulted in a data base that is second to none. We have learned that about 3,500,000 acres of forest soils in Minnesota are sensitive or potentially sensitive to acid deposition. That represents about 19% of the forested land in Minnesota.

Although Minnesota is known as the land of 10,000 lakes, we really have more than 12,000 lakes larger than 10 acres. Of those, the MPCA estimates that between 1,500 and 2,500 lakes in Minnesota are sensitive to acid deposition. That represents about 25% of the lakes in the state that are classified as fishing lakes.

In addition to our concerns about lakes and forests, MPCA estimates that 1,200,000 acres of peatlands in Minnesota may be affected by acid deposition. Some of these sensitive peatlands represent a unique wilderness of wildlife and vegetation that cannot be found in any other state outside of Alaska.

Altogether, we believe that about 15% or almost 8,000,000 acres of Minnesota's forests, peatlands, and watersheds are sensitive to acid deposition. The attachment to my testimony is a map of the sensitive and potentially sensitive areas in Minnesota. These areas cover much of eastern and northeastern Minnesota and include Voyaguers National Park, the Superior National Forest, the 1,000,000 acre Boundary Waters Canoe Area Wilderness (BWCA) and even include some park and forested areas in the Twin Cities.

Agriculture, tourism, and forestry are the three largest industries in Minnesota. Two of these industries, tourism and forestry, are seriously threatened by acid rain. Agriculture, though not currently threatened, could be affected if rainfall becomes more acidic in the future. As far as tourism is concerned, one study shows that the first signs of lake acidification in the BWCA could result in an annual loss of about $40,000,000 per year and 3,000 jobs. That represents only a fraction of the total tourism and sport fishing industry in Minnesota. We are very proud of our beautiful environment in Minnesota; the many lakes, the forest, Voyaguers National Park, and the Boundary Waters Canoe Area wilderness. So acid deposition is an economic, environmental, and emotional issue to our state.

According to the MPCA, rainfall in Minnesota ranges from well-buffered rain in western and southwestern Minnesota to highly acidic rain with pH's in the low 4.0's in the extreme northeastern part of the state. Unfortunately, the rain is most acidic in the areas that are most sensitive. So far, there are no dead lakes in Minnesota. However, based on the Scandinavian experience, the acidity of precipitation and the rates of deposition in northeastern Minnesota is already great enough to begin causing subtle chemical changes in our most sensitive resources. MPCA's computer modelling shows that 20% to 30% of the acid deposition falling in Minnesota comes from sources within the state. Another 20% or so comes from Canadian sources, primarily smelters in Ontario and Manitoba. The remaining 50% comes from other states. The other states contributing to acid deposition in Minnesota include our neighboring states to the west, east, and the south. North Dakota, Missouri, western

Illinois, and Canada are likely the largest out-of-state contributors.

Minnesotans recognized that our own emissions contribute significantly to acid deposition in our own state. As a result of environmental concerns and the responsible action of industry, emissions of sulfur dioxide in Minnesota are much lower today than ten years ago. We intend to reduce emissions even further. In 1982, the state legislature passed a bill known as the Minnesota Acid Deposition Control Act. This establishes Minnesota as the first state to begin regulating acid deposition. As a result of that Act, we have developed a formal inventory of sensitive resources. We are now in the process of developing a formal acid deposition standard to protect those resources. By January 1, 1986, we will have developed a control plan to meet the standard, and our sources must be in compliance by 1990.

Even though the Acid Deposition Control Act sets a rigid schedule for reductions by establishing a 1990 compliance date, we have already begun reducing emissions in Minnesota. Northern States Power Company (NSP) at the MPCA's request, has agreed to reduce emissions at three of its existing power plants in order to offset emission growth that is likely to result from the construction and operation of a new coal-fired power plant which is currently under construction. This action demonstrates how we can reduce emissions and accommodate future growth.

As far as federal action is concerned, Minnesotans are frustrated with the sluggish reactions of Congress and the federal government. We are naturally concerned that any federal legislation address acid deposition in such a manner that will ensure adequate protection for Minnesota's sensitive resources. The steps necessary to control acid deposition in Minnesota are similar but at the same time, geographically different than those necessary to control acid deposition in New England and New York. This is because the sources that contribute the most to acid deposition in Minnesota are different than the sources that contribute the most to deposition in New England. Different sources contribute to acid deposition in the Western states and in the Southeastern states as well. The following concepts that I will present strive to address the geography of acid deposition equitably, and in such a manner that will protect our resources.

First, an interim freeze or cap on total U.S. emissions of sulfur dioxide from major sources (sources greater than 100 tons/year) should be initiated to ensure that emissions of sulfur dioxide do not increase until a federal control plan or legislation is enacted. This action is needed to prevent exacerbation of the acid deposition problem in areas that are already being affected. Such a cap could be applied on a state-wide basis to allow the state flexibility in accommmodating future growth in a manner that best suits the state.

Second, again to help accommodate future growth, all major new sources should be required to employ the "Best Available Control Technology", which is an existing requirement of the Clean Air Act.

Third, current research indicates sulfur dioxide is the pollutant that is primarily responsible for long-term acidification of the environment in much of the United States. Because more is understoood about the effects of sulfur dioxide on the environment, legislation should be primarily addressed to sulfur dioxide at this time. However, we recognize the concerns about other pollutants' contributions to the problem and believe that legislation should not exlude control of other pollutants, particularly as more is learned about their contributions.

Fourth, all states should be included in federal acid deposition control legislation. Acid deposition is not just an eastern U.S. problem. Sensitive resources exist in the Northeast, the Southeast, the Upper Midwest, and throughout the mountains of the West. Unfortunately, rainfall is acidic in many of these areas. Sources of sulfur dioxide and acid deposition exist in every state. Therefore, every state should have protection from acid deposition and every states' sources of acid deposition should be considered for control. A bill that is drafted solely to reduce acid deposition in New England may not significantly reduce acid deposition in the Upper Midwest, or the Rocky Mountains.

Fifth, to adequately protect sensitive resources in the United States and Canada, a reduction in sulfur dioxide emissions on the order of 50% is warranted. This represents a reduction of 10,000,000 to 12,000,000 tons/year in the United States. Emission reductions can be allocated in a number of ways. The method of allocation should take into consideration existing emission levels and emission rates, so as to credit states that already employ emission controls.

Sixth, strengthening language must be added to the existing provisions for interstate transport of pollutants in the Clean Air Act. The current interstate transport provisions do not recognize acid deposition as a form of pollution. Sections 110 and 126 must be strengthened to ensure that one state is prevented from emitting air pollution which could endanger public health or welfare in another state, regardless of violations of ambient standards. Modification of these sections of the Act becomes even more important if legislation is not applied to all states.

I now will offer some specific comments related to H.R. 3400.

First, since H.R. 3400 does not contain provisions for a cap on emissions, we support additional reductions beyond 10,000,000 tons per year to address the concerns of future growth in emissions. A 12,000,000 ton per year reduction, for example, will help offset future growth.

Second, the allocation of emission reductions among the states should be revised to reflect current emission rates, or in other words, the current degree of pollution control in individual states.

Third, the trading of emission reductions between states should be limited geographically, so that the reductions are achieved within the same geographic region.

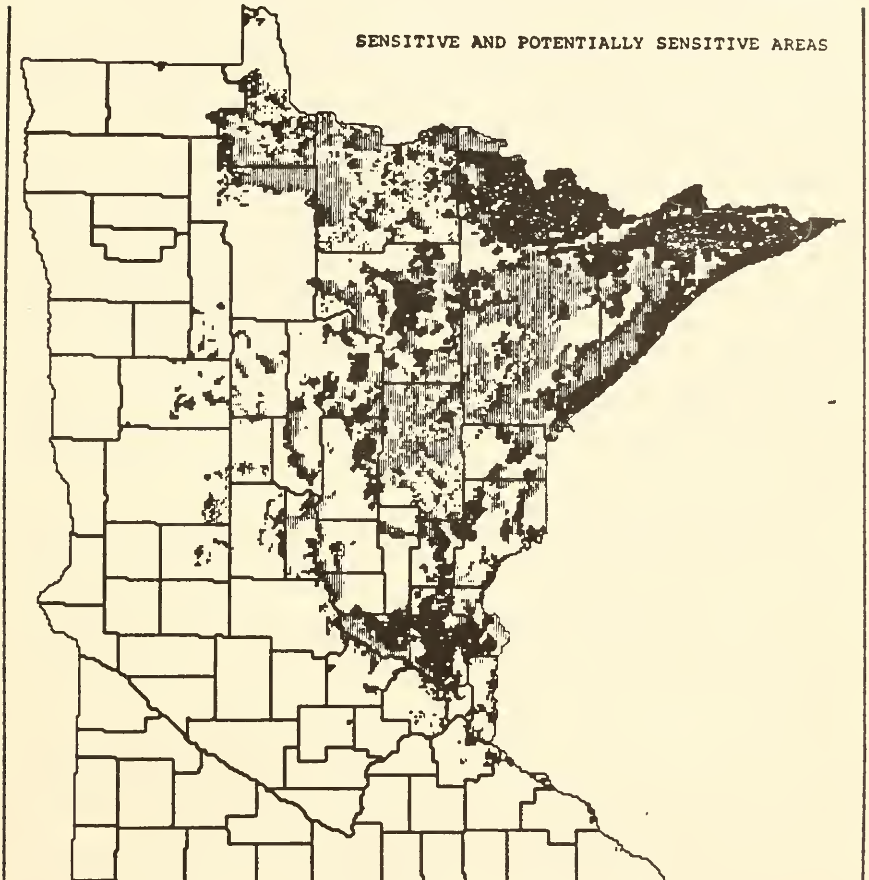
Finally, I would like to comment on the concept of a funding mechanism for the purpose of assisting in mitigating the costs of complying with a control act. Most current federal legislation that controls air and water pollution revolves around the concept that the polluter should bear the cost of pollution control. Ideally, that concept should work for acid deposition as well. Therefore, we prefer no funding mechanism for acid deposition control.

However, we also recognize the necessity of developing legislation that is politically acceptable to Congres in order to achieve our goal of mitigating acid deposition in a timely manner. A funding mechanism may indeed be necessary in order to meet that goal. If some type of a funding mechanism is to be added, we prefer one that recognizes, to some extent, the existing degree of pollution control in a state. H.R. 3400 establishes one type of mechanism. Many others have been proposed. The most important issue to Minnesotans is reducing acid deposition. Therefore, we support whatever type of funding is required to move legislation through Congress. The benefits of controlling acid deposition will more than offset the costs of funding the reductions of sulfur dioxide emissions.

We believe strong acid rain legislation must be passed by Congress in 1984. Your bill, H.R. 3400, is the most viable bill under consideration in the House. We support it and your efforts to solve this critical environmental problem.

Again, thank you for the opportunity to discuss this important issue. Sandra S. Gardebring, Executive Director of the Pollution Control Agency is here with me today, and together we would be happy to answer any questions you may have. Good luck in your efforts to pass acid legislation in Congress.

ATTACHMENT



Mr. WAXMAN. Thank you very much for your testimony on the problem. I appreciated some of the specific suggestions you made for us to look at in this legislation.

As you know, the problem we have had is getting a bill passed. It would be far fairer and makes a lot more sense, if we are looking at the problem in an abstract academic way, to say that if you are the source of the pollution you are the party responsible for stopping that pollution and should bear the cost for it.

Our whole body environmental protection laws has always incorporated the internalization of costs by the polluter in order to limit the amount of pollution. But we have a problem that makes it impossible for us to pass legislation along those lines, because there would be an enormous economic dislocation and loss of a quarter of a million jobs in the Midwest. If we had that kind of a situation we would have one region pitted against another, and the stalemate that we have had for a number of years now would keep us from making any progress.

So as we look at legislation we have got to be as practical and as fair as possible and balance out these legitimate concerns. But what we need to do is get going and get something moving to control acid rain.

Thank you very much. Mr. Sikorski.

Mr. SIKORSKI. Thank you very much, Mr. Chairman. I know both of you have been very active in our State on environmental issues. I think we have an agreement with Ontario now that you both have been personally involved in negotiating and executing. Minnesota has been a leader. Our industries have been a leader and our Government has been a leader in the United States. But we have to do more.

I thank you for the testimony. It was very helpful and we are going to try to do what we can in terms of making this national bill as much a benefit to Minnesota at the least cost. If I had my druthers it wouldn't cost us a cent, any of my voters a cent. But we have a lot at stake as everyone is recognizing this morning.

I was just interested in one thing. On the NO_x SO_x discussion this morning, the point is we should concentrate on SO_2. The evidence I have seen talks about how in a State with snow, such as Minnesota, the spring melt causes an acid rush as a result of the NO_x. Is that conclusion somewhat up in the air yet, or isn't that as big a problem for Minnesota as just the SO_2 numbers?

Ms. GARDEBRING. Mr. Chairman, if I might answer that question. Mr. Sikorski, it is our position that is reflected in the testimony is not to be critical of your bill. Some of the previous bills that were introduced focused more on NO_x and less on sulfur dioxide.

I think the mix that you have in your bill is an appropriate one. As to the specific issue of NO_x impacts during snow melt, I think we feel that is a problem. There is scientific evidence on that issue. We don't feel it is as clearly documented as the sulfur dioxide impact. Our concern is that there be sufficient focus on the sulfur dioxide issue.

I think a bill that has some of both is a good bill, as long as the main thrust of the reduction is on sulfur dioxide, and your bill does that.

Mr. SIKORSKI. I know Senator Steve Novak is here. I would just like to compliment again the Pollution Control Agency and the director. The three of us have gone through a lot. We are getting old. We have been friends and associates for almost 20 years now. It is nice that we are attacking one of the, I think, most significant problems that the next generation of Minnesotans. I want to compliment MPCA in terms of its research, professional approach, public policy, encouragement, negotiations. Thank you.

Mr. WAXMAN. Just one question before you leave, because you both have looked at this problem in a great deal of detail. When we met last in New York we heard testimony from the utilities that they don't feel enough is known about the cause and effect of acid rain to seek an immediate national solution to the problem.

How would you respond to that claim?

Ms. GARDEBRING. Let me respond, if I might. After you have been in the business of environmental regulation for awhile, as you have, and as I have, you find these arguments coming back over and over again. I don't think there is any question but that on environmental issues we never fully know the cause and effect relationship.

But there is also no question in my mind, and I think all of the Reagan administration's scientific panels have said very clearly that reductions of SO_2 will create correlating reductions of acid rain. I think the main points, the main scientific issues are very clearly documented and agreed on. So I cannot agree with utilities. I think that you will find at least for some of the Minnesota utilities, that they are not sharing that position with their eastern colleagues. So I think there is no question that the fundamental scientific issues on cause and effect have been dealt with. We simply can't wait for the research and pray now approach Mr. Nelson mentioned.

So I think it is clearly time to act. I don't think there is any question about the scientific validity of the fundamental conclusion.

Mr. WAXMAN. Thank you very much. Thank you for being with us. I do want to join in with Mr. Sikorski in acknowledging the presence of Senator Steve Novak.

We now would like to call forward a number of witnesses who will testify as a panel. John Grzybek, a conservation chair, Northstar Chapter, Sierra Club; Jeanne Crampton, League of Women Voters of Minnesota; Bill Radio, president, Minnesota Municipal Utilities Association; Paul W. Hansen, natural resources and conservation editor, Fishing Facts Magazine; Michael Gregerson, acting director, Environmental and Regulatory Activities Department, Northern States Power Co.; Jerry Anderson, Izatys Lodge; and Barbara L. Hughes, managing director, American Lung Association of Minnesota. If you would all come forward and take seats we would like to hear from you.

Before we call on the members of this panel Representative Willard Munger would like to have made part of the record a resolution that has been adopted by the house.

Mr. SIKORSKI. Willard, has that resolution been adopted by the House?

Mr. Munger. This resolution was adopted in the 1982 session, and also in the 1983 session, almost with a unanimous vote, and a strong resolution calling for the Congress of the United States to take immediate action.

Mr. Waxman. Thank you very much. We are pleased to have this resolution and we will make it part of the record for this hearing so that we can share views of the House of Representatives, State of Minnesota, with our colleagues of the Congress.

Mr. Munger. As long as your rules are such that I am not supposed to testify, I will submit my remarks.

Mr. Waxman. We would be pleased to have your comments and any of the comments that other members of the legislature would like to have inserted into the record. We will make it part of the record. Thank you very much for being with us.

Why don't we start with Mr. Grzybek.

STATEMENTS OF JOHN GRZYBEK, CHAIRMAN, CONSERVATION COMMITTEE, NORTH STAR CHAPTER, SIERRA CLUB; JEANNE CRAMPTON, LEAGUE OF WOMEN VOTERS OF MINNESOTA; PAUL W. HANSEN, NATURAL RESOURCES AND CONSERVATION EDITOR, FISHING FACTS MAGAZINE; WILLIAM RADIO, PRESIDENT, MINNESOTA MUNICIPAL UTILITIES ASSOCIATION; MICHAEL GREGERSON, DIRECTOR, ENVIRONMENTAL AND REGULATORY ACTIVITIES DEPARTMENT, NORTHERN STATES POWER CO.; AND BARBARA L. HUGHES, ON BEHALF OF AMERICAN LUNG ASSOCIATIONS OF MINNESOTA

Mr. Grzybek. Good morning. Thank you. Congressman, I am John Grzybek, chair of the conservation committee of the Northstar Chapter of the Sierra Club. For the past 5 years the Northstar Chapter Acid Rain Task Force has researched, debated, and participated in various conferences to understand and educate our members and the public about acid rain. We have lobbied in support of legislation at the State and Federal level and participated in public hearings.

Today my testimony is on behalf of the North Star Chapter of the Sierra Club. In addition, I am authorized to speak on behalf of the Minnesota Audubon Council, represented today by Jenny Black, and the Minnesota division of the Izaak Walton League, represented by its president, Robert Strauss.

There is a perception among some people in this Nation that the upper Midwest has no acid rain problem. We think otherwise. Our Canadian friends and neighbors think otherwise. The facts state otherwise. Acid rain knows no borders.

Parts of the Midwest are just like a patient who feels no symptoms, but whose blood and serum tests indicate the presence of an illness. Lakes in northern Minnesota and northern Wisconsin are not acidified yet. But some tests indicate they are undergoing acidification or are likely to be affected. In fact, in the Upper Peninsula of Michigan one lake has been identified as being acidified. The illness is present, but not all the obvious symptoms are evident.

Reports from the Minnesota Pollution Control Agency, the Minnesota Department of Natural Resources, the University of Minnesota, the Federal Environmental Protection Agency, and even

Northern States Power Co. have documented the fact that this region contains the three important ingredients for damage from acid rain to occur, low pH rainfall, high sulfur deposition, and sensitive areas.

These studies have shown that this region contains lakes which are as sensitive as those in other parts of the world which have sustained damage from acid rain. Observe what has happened in Norway and Sweden, in Ontario, and the catastrophe of the Adirondacks in New York. In general, northern Minnesota, northern Wisconsin, and parts of Michigan contain grantici bedrock or parts of soils have little capability to buffer the acid deposited from atmospheric sources. The results of this deposition cause the average pH rainfall throughout this region to range from approximately 4.3 in Michigan to lower than 5.0 in Northern Minnesota. Equivalent levels of acidity have caused lake acidification in other parts of the world.

Related to rainfall acidity, but perhaps even more important is the total deposition of acid onto a sensitive area. One indicator of this deposition is the amount of sulfate deposited over a particular area per year. We find that the levels of sulfate deposition in Minnesota and Wisconsin are greater than those in the interior of Norway and Sweden, where long-term environmental degradation has been documented. Thus, there is little reason to believe that the upper Midwest will escape damage from acid rain if the present deposition rates continue.

Minnesota has significant cause for concern. The comparison of current and historical alkalinities in Minnesota lakes shows that declines have occurred. The lakes are losing their buffering capacity. Currently, we know of no lakes in Minnesota which have become acid due to acid rain. This leaves us in a curious position. The good news is, we have no dead fish. The bad news is, we have no dead fish. We have no dead fish to strengthen our case for reduction of acid deposition in Minnesota. However, the process has begun. Lake McNearny in the upper peninsula of Michigan has already fallen victim. Minnesota is on the threshhold of an environmental disaster. Our fresh water resources and marvelous natural resources are at stake. For just as surely as declining fish populations in the Adirondacks indicate the final stage of acidification of a lake, chemical measurements taken in Minnesota indicate the commencing stages of acidification in our lakes.

In Minnesota we do not want to just sit back and monitor the degradation of our resources by acid deposition.

If we are to prevent the gradual acidification of waters, the loss of fish populations, as well as other ecosystem damage, we must act now to reduce the amount of acid deposited from atmospheric sources. We must control the emission of compounds which form these acids. We must attack, in Congress, the emissions of sulfur dioxide.

If we are to prevent futher damage to the environment as well as the health and the welfare of individuals caused by acid rain, the North Star Chapter of the Sierra Club, the Minnesota Audubon Council, and the Minnesota division of the Izaak Walton League, recommend the following position on Federal acid deposition control legislation: We support an immediate cap on sulfur dioxide emissions for all 48 contiguous States, based upon 1980 actual annual emissions. Anything less than this would be detrimental to those areas of the upper Midwest that are affected by pollutants from the West.

Anything less cannot be termed as national legislation. We appreciate the fact that H.R. 3400 is a national bill. However, the bill falls short by not requiring an immediate cap on emissions nationwide. We support an effective emissions control program for all 48 contiguous States with at least a net 11 million ton sulfur dioxide reduction in the eastern 31 State target region.

The National Academy of Sciences, the Canadian Government, and several scientists of both the United States and Canada recommend a 50-percent reduction in the emission of sulfur dioxide. We support your addressing this issue in H.R. 3400. But the reductions proposed are not great enough. We would strongly support any amendment which would increase that amount of sulfur dioxide reduction in H.R. 3400. We support the addition of more comprehensive language to address the issue of interstate pollution. H.R. 3400 currently has no provision for seeking relief from emissions that are contributing to acid deposition, but otherwise comply with the Clean Air Act. Language that provides a mechanism from one State to seek additional relief from another is essential for Minnesota to fully protect its sensitive resources.

Section 110(a)(2)(E) of the existing Clean Air Act should be amended to identify acid deposition as a form of air pollution and to prevent one State from emitting air pollution that may endanger public health and welfare in another State.

Section 126 of the Clean Air Act should also be amended to extend enforcement mechanisms to include acid deposition. We support provisions that require full compliance with the provisions of acid rain legislation within a 10-year period, commencing at the date of enactment.

We support allowing for offsets for growth on a State-by-State basis. That is, whenever a new emission source commences operation, equal or greater reductions must be obtained within that State. We support the establishment of a meaningful monitoring mechanism to ensure compliance with the provisions of Federal acid rain legislation and the establishment of strong penalties for stong compliance.

The penalties must be of sufficient cost so that compliance with the plan is less costly than payment of a penalty. We do not support a trade off between emissions of sulfur dioxide and oxides of nitrogen. Reduction in emissions of oxides of nitrogen are useful, but we do not want them made at the expense of emission reductions of sulfur dioxide.

We support a funding mechanism that provides the funds necessary to cover the actual cost of fully implementing and accomplishing the provisions and purposes of the act. We encourage this Congress to pass a strong and comprehensive act concerning the issue of acid rain.

Congressman Sikorski, we commend you for your current efforts and encourage this subcommittee to move forward with H.R. 3400 as the vehicle for final acid rain deposition. There is much work to be done. Remember, for every week that legislation is delayed, another lake may die.

For every year the legislation is delayed, our environment, our health, and our welfare is jeopardized. Acid rain is clearly a national problem. It knows no borders. It is reaking havoc with our air, land, and water. Something must be done to control this pollution.

This subcommittee should leave this room knowing that Minnesotans stand ready to pay the average annual price of H.R. 3400, the Sikorski Acid Deposition Control Act, which is $12.55. Only $1 per ratepayer, per month to control this problem.

None of us can argue that this is too much to pay for the protection of our many natural resources, including the Boundary Waters Canoe Area, which are critical to the continuation of the quality of life that we enjoy in this State.

H.R. 3400 goes a long way toward providing protection to Minnesota's acid sensitive resources.

I want to thank you for allowing me the opportunity to testify before the subcommittee today. The Sierra Club appreciates the leadership that both of you have shown on this issue. If you have any questions I would be happy to address those.

Mr. WAXMAN. Thank you very much, Mr. Grzybek. We are going to call on the other witnesses and then we are going to have questions for the whole panel.

We very much appreciate your testimony.

I would like to call on Jeanne Crampton from the League of Women Voters of Minnesota.

STATEMENT OF JEANNE CRAMPTON

Ms. CRAMPTON. Mr. Chairman, members of the subcommittee, I am Jeanne Crampton, natural resources director for the State League of Women Voters of Minnesota.

As the first state to actually have attempted to control the deposition of acid precipitation, we feel Minnesota was a logical and delightful choice for this hearing. Thank you for coming.

I see no reason to repeat all of the excellent environmental testimony that has already been heard. Be assured that the League of Women Voters of both Minnesota and the United States are very concerned about acid precipitation and we concur with both the attitude that is is a problem, and also for the reasons for that problem.

We don't feel that we need to spend a whole lot more time studying it before we actually direct our efforts to try and control it. The League of Women Voters, as with all of the other leagues in the United States supports H.R. 3400 as a workable strategy for controlling acid rain, although we recognize it is not a perfect document. We certainly hope that the bill can be strengthened by increasing the sulfur dioxide reduction targets, possibly somewhere between 12 to 13 million tons per year.

We agree with the Sierra Club Audubon that the cost of—to an average rate payer, which assuming an average rate payer might pay or might use 500 killowats per hour, killowat hours per month, would be somewhere around 50 cents a month. We feel this is a very, very small price to pay for cleaning up the North American air and strengthening those life support systems that are so necessary to us all. Thank you.

Mr. WAXMAN. Thank you very much. I would like to hear from Paul W. Hansen, natural resources and conservation editor, Fishing Facts Magazine.

STATEMENT OF PAUL W. HANSEN

Mr. HANSEN. Mr. Chairman, Representative Sikorski, and members of the Legislature, and other distinguished guests, my name is Paul Hansen and I want to thank you for the opportunity to appear here before you today as natural resource and conservation editor for Fishing Facts Magazine, which has a circulation of some 350,000, largely based in the Midwest.

In addition to my work with the Fishing Facts I also represent the Izzak Walton League of America, a national citizen-based conservation organization. I sit on the advisory board of the American League of Anglers, and the Acid Precipitation Committee of the International Association of Fish and Wildlife Agency. I am an active member of the Outdoor Writers Association of America, and the Association of Great Lakes Outdoor Writers.

In addition, I am a private consultant and freelance writer who has worked almost exclusively on acid rain for the past 3 years.

Today I am here at your invitation to discuss the overwhelming consensus among the Nation's sportsmen and women that we act in this Congress to stop acid rain. According to the new figures from the Interior Department and the American Fishing Tackle Manufacturers' Association, over 59 million Americans fish regularly. Virtually every fishing club or organization, and every fishing magazine are calling for deductions of acid-causing pollutants which you call for in your bill.

This huge constituency is not organized yet into an effective lobby. However, these sportsmen are united by their frequent contact with regional and local outdoor writers. During the past year, I have been guest speaker at six regional and the national conventions of outdoor writers.

There is a concensus among these writers and their 59 million readers to stop acid rain. Their message is strong, consistent, and decisive, like this one from Karl Wickstrom, the publisher of Florida Sportsman Magazine, the largest magazine published in Florida,

> I am confident that I speak for the overwhelming majority of the quarter-million readers of Florida Sportsmen Magazine, the largest magazine published in this State. When I emphasize that we must demand quick action to greatly reduce acid rain. We must cut through the smokescreens and delaying tactics of the polluters, and accept the consensus view of the world's leading scientists that acid rain is doing ever more damage as we continue to drag out collective feet.

Or this quote by Ed Zern of Field and Stream Magazine with a circulation of almost 2 million,

> Can you help stop acid rain before it destroys even more of your sportfishing birthright? You certainly can. Write your Congressman urging him or her to support the Waxman legislation on acid rain. Let them know you want action and will vote accordingly next election time.

Or George Pazik, editor and publisher of Fishing Facts, "Narrow selfish interests argue that 'Years of study are needed' on the problem, but the bulk of informed scientific opinion says flatly that we know enough about it to act now."

Or what it might be perhaps the most compelling comment from a Georgia writer, "If our lakes down here start going acid, there are going to be some hangings."

The concerns of the fishing tackle industry itself are starting to be heard. Last July, Zebco, Inc., the world's largest fishing tackle manufacturer, announced their support for acid rain controls and gave $100,000 to form the FishAmerica Foundation to educate the fishing public on acid rain and other fisheries' issues. The prestigeous International Association of Fish and Wildlife agencies endorsed H.R. 3400 in September, and the American Fishing Tackle Manufacturers Association, representing a $16 billion industry are now working on the final wording of similar endorsements.

The National Sporting Goods Association recently reaffirmed their commitment to support, "An immense Groundswell of public support for immediate action, which is necessary to prevent further irreparable damage. The NSGA takes a strong stand on this matter."

Mr. Chairman, an immense groundswell of public support from the Nation's outdoorsmen and women is beginning. We know, all too well, of the damage to the $150 million Adirondack Sportfishery and of the new reports from the Pennsylvania Fish Commission that 6,000 miles of prime trout waters will soon be lost, at a capitalized value of over $1 billion. We know that damage is spreading in sensitive areas throughout the Nation and that even slight increases in acid contriubte to the mercury contamination of gamefish. We know that this year sportfishing brought $500 million to the Wisconsin economy, $400 million to the Minnesota economy, and billions of dollars to the national economy.

By 1995, Minnesota expects sportfishing to bring $1.6 billion to the State economy. I might mention that last Thursday the U.S. Forest Service researchers predicted that at present deposition rates, 5 to 7 percent of the lakes in the northern areas of Minnesota, Wisconsin, and Michigan will soon be acidified.

Sportsmen know that the damages in other areas, such as forestry, agriculture, human health, and building materials will likely be higher when and if we are ever able to quantify them.

While we do not dismiss the costs of acid rain control, compared to the costs of no control, they are a bargain. In fact, since 1950 the Nation's fishermen have taxed themselves more through the "Federal Aid to Fish Restoration Act" levies on fishing tackle. Clearly, our society remains strong enough to afford a healthy sport fishery and a healthy economy.

The importance of this groundswell has not gone unnoticed by opponents of acid rain control. A recent report by the Hudson Institute expressed the concern that sportsmen, "Are basically low-profile people. They can become very active if they believe their favorite recreation is threatened. Potentially, a great concentration of public opinion on legislation dealing with acid rain might stem from a coalition of some otherwise unlikely partners."

With additional support, groups like the Izaak Walton League, who have historically served this constituency, could do much more to concentrate the impact of this massive public voice. As you know, Mr. Chairman, many of us would like H.R. 3400 offset pollution, from new sources. Others question why States, like Minnesota, whose emissions rates are already low, should be compelled to participate in a national cost-sharing program. It is my perception, and that of most of my colleagues, that as justifiable as those concerns are, it is simply not politically possible at this time to attain significant emissions reductions without making these concessions.

We must have action in the 98th Congress to reduce acid rain. For the Nation's 59 million Americans who are angling for an end to acid rain, your bill, H.R. 3400, is the best bait we have. I encourage all of those who share our desire to stop acid rain to work together to assure that our final legislative solution is a keeper.

Thank you.

Mr. WAXMAN. Thank you for that testimony. I would like to now recognize Bill Radio, president of the Minnesota Municipal Utilities Association.

STATEMENT OF WILLIAM RADIO

Mr. RADIO. Thank you, Mr. Chairman, Representative Sikorski, and members of the legislature, for this opportunity to comment on acid rain legislation.

I am William Radio, president of the Minnesota Municipal Utilities Association, and city administrator of the city of Chaska, Minn. Accompanying me today seated over here is Michael Bergman, staff scientist for the American Public Power Association who has taken a similar position to the one that we are presenting to you today.

The Minnesota Municipal Utilities Association is a 51-year-old organization representing the interests of Minnesota municipals who own electric or gas utilities, and in some instances, district heating systems. The association has 96 active and regular members serving over 500,000 citizens, making the association the largest consumer representative group for utility matters in the State.

For the sake of brevity, I am going to abbreviate my remarks. You do have a complete copy of them submitted to you. As attachments to that we are including a list of our members, a resolution recently passed by our association.

As you know, efforts to lessen the potential damage from acid rain may cost vast sums of money. The consumers of the municipal electric utilities in Minnesota are served by electrical energy generated in large part by fossil fuel. It is therefore the responsibility of municipal electric utilities in Minnesota to balance their consumer owners' interests for a clean environment with the need for a reliable electrical power at a reasonable cost, all within an uncertain framework as to how best to control acid rain.

We believe our resolution achieves these objectives. Points included in that resolution are as follows: No. 1, a nationwide funding mechanism based on sulfur dioxide and nitrogen oxide taxes on emissions from all fossil fueled sources; No. 2, funds raised to be applied to the capital costs of the most cost-effective emission reduction measures; No. 3, emission reductions based on a pay-as-you-go approach; No. 4, adoption of a two-phase reduction program with implementation of the second phase, based on an affirmative decision that the program is achieving its objectives; No. 5, actual, rather than allowable emissions used as the basis for the task; and finally, emission reduction goals should adequately account for future growth.

I would like to just further comment on each of these points briefly. On the nationwide funding mechanism for acid rain, we feel that is essential. A nationwide funding mechanism should be applied to sulfur dioxide and nitrogen oxide emissions on all mobile and stationary fossil-fueled sources for which an emissions tax is feasible.

Sources specifically include cars, trucks, smelters, industrial oilers, industrial processors, and utility boilers. MMUA opposes proposals that would tax on the basis of killowatt hours or British thermal units or other units of measurement not related to the source of the problem.

The problem is the emission of pollutants and the solution should be a tax on those emissions. Furthermore, an emissions tax provides credit for past clean up efforts and incentives for future clean up. For example, since the early 1970's electric utilities in Minnesota have reduced their emissions of sulfur dioxide by about a third or approximately 100,000 tons. Under approaches relying on killowatt hours or Btu taxes, these responsible reductions would not be acknowledged.

Second, MMUA believes the moneys raised through the emissions tax should be used to fund all of the capital costs of the most cost effective and verifiable emission reduction measures. Estimates for the cost saving of a cost effectiveness approach, as opposed to an approach mandating continuous emission reduction technology or scrubbers have been conservatively placed at 25 percent.

Even assuming that large unemployment impacts from excessive fuel switching would occur and are unacceptable. Such impacts should be examined carefully, minimized extra costs. We believe that analysis will suggest measures other than prohibition, including minimum limitations on nonelimination of fuel switching or adoption in defined cases of retraining and relocation programs.

In deciding cost effectiveness, MMUA urges that site specific factors include limiting the practicability of retrofit operation and maintenance costs, capital costs, and the useful remaining lifetime of facilities be considered. In essence this recommendation suggests a life cycle costing basis for evaluating emission reduction measures. As effective control measures are applied to individual sources, emissions tax will automatically be reduced, which will partially offset any increased operating and maintenance cost. The cost effectiveness criterion also demands that wherever sensitive areas and sources can be linked, allowances must be made for targeting emission reductions to provide that those areas are given priority over less sensitive areas.

Third, the Association urges that whatever form of legislation is passed embody a pay-as-you-go or clean-as-you-pay strategy. This recommendation means that the financing program would remain in effect until emission reduction goals are met, and that sources required to reduce emissions, at the end of the program are assured of having the same financing support as those required to make reductions at the beginning of the program.

MMUA supports a two-phase reduction program with the continuance of the second phase contingent upon affirmative action of the Congress that the program is achieving its objective. This recommendation assures that midcourse corrections can be made in the program if necessary.

Complimentary to a two phase program is continued and enhanced acid rain research and the establishment of an adequate monitoring program. Fifth, as a basis for determining the emission tax liability, MMUA urges that taxes on stationary sources be based on actual rather than allowable emissions.

Approximately three-quarters of MMUA's members have their own generating capacity, which is largely used intermittently during periods of peak demands, or during infrequent times when the primary power supply is unavailable. Tax liabilities should reflect the actual emissions of these sources rather than their potential.

These emergency power sources are important to the security of Minnesota's energy supply and should not be taxed out of existence. Sixth, MMUA urges that any emission reduction goals proposed in acid rain legislation adequately account for future growth. Without a proper accounting for growth, overall emission reductions are understated.

Further, new capacity is subject to a double whammy, first, paying for control technologies to meet new source performance standards. And, second, paying for offsets from existing sources for the emissions that remain after control.

In conclusion, Mr. Chairman, MMUA believes that our recommendations are geared to address the public interests. We are willing to take responsibility for the costs and requirements of acid rain and the controls in direct proportion to our responsibility for the problem.

I think it is significant that Minnesota Electric Utilities are consumer-owned entities, and are the only segment, I guess with the exception of my colleague here from MSP, to recommend action on how to deal with this problem.

In fact, at the national level, the American Public Power Association, through actions of its special task force on acid rain, has been on record since August of this year in support of acid rain legislation. Their position is also submitted with our testimony.

Mr. Chairman, I thank you and the committee for the opportunity to present our views on this subject of keen national interest.

[Testimony resumes on p. 250.]

[Mr. Radio's prepared statement follows:]

STATEMENT ON ACID RAIN LEGISLATION

Presented to the Field Hearing of the
ENERGY and COMMERCE COMMITTEE
U. S. House of Representatives
at
the University of Minnesota, Nervada Campus
by the
MINNESOTA MUNICIPAL UTILITIES ASSOCIATION
October 28, 1983

Mr. Chairman, thank you for this opportunity to present the views of the Minnesota Municipal Utilities Association (MMUA) on acid rain legislation. I am William Radio, President of MMUA, and City Administrator of the municipality of Chaska. Accompanying me this afternoon as technical advisor is Michael Bergman, Staff Scientist for the American Public Power Association.

The Minnesota Municipal Utilities Association is a 51-year old organization representing the interests of Minnesota municipalities who own electric and/or gas utilities, and, in some instances, district heating systems. The Association has 95 active and regular members and serves over 500,000 citizens. The Association is the largest consumer representative group for utility matters in the state. The Association is governed by a nine-member Board of Directors, with day-to-day activities administered by R. G. Kirkham, Executive Director, at the Association's Buffalo, Minnesota, headquarters. All Association policy is approved by the full membership. A list of MMUA members is shown in Attachment I. (May be found in subcommittee files)

Mr. Chairman, on October 26, 1983, MMUA's full membership passed a resolution supporting what we believe is a fair, reasonable and cost-effective approach for dealing with the problem of acid rain. The full text of that resolution is reproduced as Attachment 2. I would like to spend the next few minutes outlining the major provisions of that resolution and the reasons underlying their adoption by MMUA.

Mr. Chairman, I know you appreciate the potential seriousness that acid rain poses to sensitive ecosystems. The consumers of the municipal electric utilities in Minnesota, indeed, all Minnesotans, have demonstrated a concern for acid rain. As you may know, Minnesota is the only state in the Union to have a program for lessening acidic deposition.

National efforts to lessen the potential damage from acid rain may cost vast sums of money, approaching $50 billion to $80 billion nationally over the lifetime of the program as estimated for some of the proposals before the Congress. Though a scientific concensus seems to be emerging that acid rain is a problem and should be controlled -- as embodied in the recent panel study of the National Academy of Sciences and the report to the White House's Office of Science and Technology Policy -- controversy still exists among reasonable and responsible scientists as to the causes, sources, extent and effect of acid precipitation. Apparently, all that can conclusively be stated at this time is that all fossil fuel combusion emissions from both local and distant sources may be involved, including sulfur, nitrogen, chloride, and, perhaps, trace element emissions.

The consumers of the municipal electric utilities in Minnesota are served by electrical energy generated in large part by fossil fuels. Several systems own their own generation resources, while others receive their power from wholesale suppliers who rely on fossil-fueled generation. It is therefore the responsibility of municipal electric utilities in Minnesota to balance their consumer-owner's interests for a clean environment with the need for reliable electrical power at a reasonable cost, all within an uncertain framework as to how best to control acid rain. We believe our resolution achieves these objectives.

In summary, MMUA's position has the following key features:

1. A nationwide funding mechanism based on SO_2 and NOx taxes on emissions from all fossil-fueled sources.
2. Funds raised to be applied to the capital costs of the most cost-effective emission reduction measures.
3. Emission reductions based on a "pay as you go" approach.
4. Adoption of a two-phase reduction program, with implementation of the second phase based on an affirmative decision that the program is achieving its objectives.

5. Actual, rather than allowable, emissions used as the basis for the tax.
6. Emission reduction goals should adequately account for future growth.

Each of these points will be addressed in turn.

1. National Funding Mechanism.

We believe a nationwide funding mechanism for acid rain controls is essential. While MMUA believes that the costs of cleanup should be borne by sources contributing to the program insofar as reasonably possible, the already economically distressed industrial Midwest could face unacceptable additional burdens. Further, areas throughout the United States may be sensitive to effects from acid deposition and a nationwide approach avoids drawing arbitrary boundary lines between those who are and who are not liable to the costs of control. Finally, under the emissions tax recommended below, reduction of tax payments resulting from lower emissions in areas not sensitive to acid rain can produce ancillary benefits such as improved visibility.

The nationwide funding mechanism should be applied to SO_2 and NOx emissions on all mobile and stationary fossil-fueled sources for which an emissions tax is feasible. Sources specifically include cars and trucks, smelters, industrial boilers, industrial processes, and utility boilers. "Feasibility" would be an administrative determination by the U.S. EPA.

MMUA opposes the alternative funding mechanism contained in some legislation proposals which would tax kilowatt-hours, British thermal unit (Btu) or other units of measurement not related to the source of the problem. The problem is the emission of pollutants and the solution should be a tax on those emissions.

Furthermore, an emissions tax provides credit for past cleanup efforts and incentives for future cleanup. For example, since the early 1970's, electric utilities in Minnesota have reduced their emissions of SO_2 by about one-third, a reduction of about 100,000 tons. Under approaches relying on kilowatt-hour or Btu taxes, these reductions would not be acknowledged. And, with regard to incentives for future cleanup under an emissions tax, estimates provided by the U.S. Environmental Protection Agency indicate as many as 2 million tons in SO_2 may be reduced without mandated measures through avoidance of the tax.

MMUA, for the reasons stated above, does not agree with the argument that because everyone uses electricity or because it is administratively simple to tax electricity generation, a kilowatt-hour tax is superior to an emissions tax.

2. Funds Used to Pay Capital Costs of Emission Reduction Measures.

MMUA believes that the monies raised through the emissions tax should be used to fund all of the capital costs for the most cost-effective and verifiable emission reduction measures. Such measures for SO_2 reductions specifically include fuel switching, fuels pretreatment, flue-gas desulfurization ("scrubber") systems, and other measures now under development whose performance can be verified over the course of the program.

Estimates for the cost savings of a cost-effectiveness approach as opposed to an approach mandating "continuous emission reduction technologies," or scrubbers, have been conservatively placed at 25 percent. Given present uncertainties in source-to-receptor relationships for acid raid and the absolute lack of evidence that SO_2 emissions reduced through scrubbing offer any benefits over other SO_2 reduction measures, requiring continuous emission reduction technologies should be rejected on simple economic grounds.

MMUA acknowledges that certain emission reduction measures, specifically fuel, are politically controversial on economic, not environmental grounds. However, even if fuel switching is legislatively foreclosed, the use of cost-effectiveness standard is valid. The program's cost-effectiveness over other approaches would be lessened but not lost. Even assuming that large unemployment impacts from excessive fuel-switching would occur and are unacceptable, such impacts should be examined carefully to minimize extra costs. We believe that analysis will suggest measures other than prohibition, including minimum limitations on, not elimination of, fuel-switching, or adoption in defined cases of retraining and relocation programs.

In deciding cost-effectiveness, MMUA urges that site-specific factors limiting the practicability of retrofit, operation and maintenance costs, capital costs, and the useful remaining lifetime of facilities be considered. In essence, this recommendation suggests a life-cycle costing basis for evaluating emission reduction measures.

The rationale for applying funds only to capital costs is based on the fact that application of the funds to operating and maintenance costs will only dilute the effort or require higher tax levels. Further, with O&M support included under a cost-effectiveness approach, undue and perhaps unacceptable emphasis may be placed on fuel-switching. Moreover, for sources which could have reduced emissions in the past but chose not to do so, funding both capital and O&M costs may not adequately apportion costs in terms of contribution to the problem. In any case, as effective control measures are applied to individual sources, the emissions tax will automatically be reduced which will partially offset any increased operating and maintenance costs.

The cost-effectiveness criterion also demands that wherever sensitive areas and sources can be linked, allowances must be made for targeting emission reductions to provide that those areas are given priority over less sensitive areas.

3. A "Pay As You Go" Approach.

The Association urges that whatever form of legislation is passed embody a "pay as you go" or "clean as you pay" strategy. This recommendation means that the financing program would remain in effect until emission reduction goals are met, and that sources required to reduce emissions at the end of the program are assured of having the same financing support as those required to make reductions at the beginning of the program. Programs based on unrealistic promises backed by inadequate funding will be accepted reluctantly if at all by consumers and industry alike.

4. Two-Phased Reduction Program.

MMUA supports a two-phased reduction program, with the continuance of a second phases contingent upon affirmative action of the Congress that the program is achieving its objectives. Given the substantial scientific uncertainties that presently exist, the very large costs associated with any reduction program, and the likelihood that improved information upon which to base decisions will be developed in the future, this recommendation assures that mid-course corrections can be made in the program if necessary. Also, by splitting the program into two phases, greater incentive is provided to achieve the most cost-effective emissions reductions first.

Complementary to a two-phased program is continued and enhanced acid raid research and the establishment of an adequate monitoring program.

5. Taxes Based On Actual Emissions.

As a basis for determining the emission tax liability, MMUA urges that taxes on stationary sources be based on actual rather than allowable emissions. Approximately three-quarters of MMUA's members have their own generating capacity, which is largely used intermittently during periods of peak demand or during infrequent times when the primary power supply is unavailable. Tax liability should reflect the actual emissions of these sources rather than their potential. These emergency power sources are important to the security of Minnesota's energy supply and should not be taxed out of existence.

6. Emission Reduction Goals Must Account for Future Growth.

MMUA urges that any emission reduction goals proposed in acid rain legislation adequately account for future growth. Without a proper accounting for growth, overall emission reductions are understated. Further, new capacity is subject to a "double whammy:" firstly, paying for control technologies to meet new source performance standards; and, secondly, paying for "offsets" from existing sources for the emissions that remain after NSPS control. These offsets, by the way, will be some of the most costly and difficult to obtain, since the easier emission reductions at existing sources would have already been claimed to meet the emission reduction goals of the acid rain control program.

Ratepayers have the right to know what they are paying for and to be able to measure on a personal basis what they are getting for their investment. If a funding mechanism is included in any acid rain legislation, Congress should clearly state that utilities may show the cost of the program to individual consumers through a line item on utility bills.

In conclusion, Mr. Chairman, MMUA believes that our recommendations are geared to address the public interest. We are willing to take responsibility for the costs and requirements of acid rain controls in direct proportion to our responsibility for the problem. It is significant that municipal electric utilities as consumer-owned entities are the only segment of the electric industry to recommend action now to deal with this problem. In fact, at the national level, the American Public Power Association, through the actions of its Special Task Force on Acid Rain, has been on record since August of this year in support of acid rain legislation. The positions APPA has taken, shown as Attachment 3, are consistent with those of MMUA.

This action by APPA demonstrates that fair and equitable acid rain legislation can be crafted that meets the needs of our nation's various regions.

As a final note, Mr. Chairman, MMUA would like to reiterate that what we are proposing is a framework and set of goals for legislation. Because of the complexity inherent in any approach to control acid rain, MMUA hopes that the Congress will see fit to establish the targets and approach to be followed in acid rain legislation, but will leave the specific details to the regulatory process where it can be handled most appropriately.

Mr. Chairman, I thank you and the Committee for the opportunity to present MMUA's view on this subject of keen national interest.

Attachment 2

Resolution #4-83

ACID RAIN LEGISLATION

WHEREAS, the U. S. Congress and the Administration is embarked upon a course which will lead to passage of legislation and a program to abate and control the release into the environment of the major components of "acid rain", and

WHEREAS, controversy remains concerning the causes, sources, extent and effect of acid precipitation however, available data shows that fossil fuel combustion emissions from both local and distant sources are involved, and

WHEREAS, public power systems have a responsibility to participate in the formulation of legislation to ensure that its provisions meet reasonable standards of effectiveness, economy, and equity within the framework of present scientific understanding, and

WHEREAS, the consumers of the municipal electric utilities in Minnesota are served by electrical energy generated in large part by fossil-fuel sources, and

WHEREAS, the consumers of the municipal electric utilities in Minnesota have demonstrated a concern for the environment and a high standard of responsibility for the environment.

NOW, THEREFORE, BE IT RESOLVED by the Minnesota Municipal Utilities Association that:

1. A nationwide sulfur dioxide and nitrogen oxide emissions tax should be applied to all fossil-fueled sources for which an emissions tax is feasible.
    a. The Association rejects proposals that would tax only a specific region of the country or would apply such a tax only upon the electric industry.
    b. The association rejects proposals that would tax on the basis of kilowatt-hour, British thermal units or other units of measurement not related to the source of the problem. The problem is the emission of pollutants.

    An emission tax is economically efficient because it fairly apportions the tax liability to those sources contributing to the precursors causing acid rain, credits for past cleanup efforts and provides incentives for emissions reduction.

2. The funds derived from the tax should be employed to finance verifiable emission reduction measures which will reduce emissions in accordance with the reduction goals specified in the legislation.
    a. Proven technology and methods exists that will reduce emissions of the target pollutants and other technologies and methods will undoubtedly surface. Use of the tax for demonstration and research projects may encourage the use of unproven technologies, delay the cleanup program and increase ultimate costs to the public.
    b. Funding for the development of new technology should be funded instead of using the normal appropriation process.

3. The purchase of emission reduction measures should not be mandated in excess of the monies available in the fund. This assures equity and

honesty by ensuring that the legislation promises no greater reduction in emissions than can realistically be achieved by the fund.

a. The Association endorses a "pay as you go" approach to the solution of the problem. Other programs have demonstrated that unrealistic promises backed by inadequate funding creates a reluctance on the part of industry and the citizens to support such programs.

4. The fund should be applied only to the capital costs of the control measures chosen.

a. Application of the funds to operating and maintenance costs will only dilute the effort or require higher tax levels. As effective control measures are applied the emission tax will automatically be reduced which will at least partially offset any increased operating and maintenance costs.

5. Emission reduction measures for stationary sources should be selected in order of cost-effectiveness, including consideration of the remaining useful life of facilities, with allowance made for administrative consideration of the likelihood of reducing impact in sensitive receptor areas.

a. Cost effectiveness demands that wherever sensitive areas and sources can be linked that allowances must be made for targeting emission reductions to provide that those areas are given priority over less sensitive areas.

b. Reduction measures should be financed on a cost effective standard in order to maximize the impact of the funds spent. Reliance solely on "continuous emission reduction technologies" can potentially increase the cost of the program without benefiting the goals of the program.

6. The emission reduction program should be divided into two phases, with the second phase to take effect contingent upon affirmative Congressional action, including findings that the program is achieving its objectives.

a. Uncertainties and incomplete scientific data as to the extent of acid rain damage, rate at which that damage is occuring and individual sources causing the damage demands a degree of caution in commitment of the large sums of monies that are involved in such a program. Requiring a second affirmative action by the Congress will allow for mid-course corrections in the focus of the program if necessary and provide greater incentive for achieving the most cost effective emissions first.

7. The program enacted should provide for adequate monitoring and continued research to gauge the effectiveness of the emission reduction program.

a. The Association strongly urges that an adequate monitoring program be established that can demonstrate the effectiveness of the program in reducing the impact of acid rain and justify the monies expended.

b. The Association urges stepped up research into those areas of scientific uncertainty such as; the role of natural acidification from humic or other organic acids in disturbed habitats, the role of local vs. long-distance sources and the rate at which damage is occurring.

8. Emission taxes on stationary sources should be based on actual rather than allowable emissions.
    a. Tax liability should reflect the actual contribution of the industry and utility source rather than the potential. Many stationary sources operate only intermittently and in the case of a number of the members of this Association only in the rare event the primary power supply is unavailable. These emergency power sources are important to the security of the state's energy supply and should not be taxed out of existance.

9. No requirements for offsets for new facilities should be included in the emission reduction program.
    a. Emission reduction goals in order to be honest must recognize future growth, trading in offsets circumvents the goals of the program by allowing existing sources to obtain not only the benefit of the reduced emissions tax but to gain from the sale of offset with the net effect that emissions are not lowered.

10. Electric utilities should have discretion to include their contribution to the emissions tax as a line item on utility bills.
    a. Citizens should have the right to know what they are paying for and be able to measure on a personal basis what they are getting for their investment.
    b. Rates are regulated and the state and local level in most states, this legislation is not the vehicle to begin to interfere with that relationship.

Adopted by the membership of the Minnesota Municipal Utilities Association this 26th day of October 1983.

Date: 10/26/83

William M. [illegible]
MMUA President

ATTACHMENT 3

POLICY REPORT
OF
APPA SPECIAL TASK FORCE ON ACID RAIN

August, 1983

I. Introduction

At the request of APPA President Robert McKinney, a 25-member Special Task Force on Acid Rain was convened in Washington, D.C., on August 10 and 11, 1983. The purpose of the Task Force is to provide interim policy guidance to APPA staff, within the framework of the Association's acid rain resolution approved on May 3, 1983. This guidance is needed to specify the positions APPA should take on proposals relating to such issues as national taxes or fees to provide a cleanup fund, and how burdens should be spread across specific regions, industries, ratepayers, or consumers. APPA's policy resolution establishes general criteria by which legislation should be evaluated, but does not address these crucial issues. Because this is a national issue potentially affecting all utilities, the Task Force has a broad geographic base, including utilities which are wholesale purchasers as well as generators of electricity. Most members of the Task Force are members of the Legislative and Resolutions Committee.

The action of the Task Force serves as interim policy subject to review or modification at the next meeting of the Legislative and Resolutions Committee in February, 1984.

II. General Conclusions: The Necessity to Support Effective and Equitable Acid Rain Control Legislation

There is now a substantial likelihood that Congress will enact legislation mandating sulfur dioxide (SO_2) emission reductions in the near future. Momentum for legislation has grown as a consequence of several developments of serious import.

These include: increasing public concern that acid precipitation resulting from fossil fuel combustion may be causing environmental damage; mounting congressional support for legislation; the recent publication of two new scientific reports which strengthen the case for action; and the Reagan Administration's anticipated endorsement of acid precipitation control legislation.

Public opinion polls indicate that an overwhelming majority of Americans favors stronger environmental protection laws, including acid precipitation control requirements. A majority of Americans indicates a willingness to pay the costs of such programs. Local public power systems share the concern of the communities they serve that the natural environment be protected.

As public concern has grown, so has congressional support for legislation. In the last Congress, legislation providing for an acid rain control program was approved by the Senate Environment and Public Works Committee. In the

98th Congress, proposals have proliferated and gained substantial cosponsorship. Most of these proposals target electric utilities almost exclusively for emission reductions; target electric consumers to pay the costs; and contain no consideration of cost-effectiveness in the control measures proposed.

Hearings are expected to begin in the House and Senate in the early fall, 1983. Predictions for the legislative timetable vary, but enactment in 1984 is widely agreed to be probable.

In June, 1983, the case for immediate action was bolstered by two scientific reports. A White House scientific "peer review" panel convened to assess the acid rain problem issued a statement of its preliminary findings, saying: "Recommendations based upon imperfect data run the risk of being in error; recommendations for inaction pending collection of all of the desirable data entail even greater risk of damage." Furthermore, the panel raised the specter of "irreversible" damage from acid rain.

At the same time, the National Academy of Sciences' National Research Council issued a report supporting a link between the level of sulfur dioxide and nitrogen oxide (NO_x) emissions and the level of acidity in precipitation. In the press release (though less clearly in the report), it was stated that "the relationship between [SO_2] emissions and [acid] deposition can be taken for practical purposes as essentially linear," meaning that most or all SO_2 is converted into sulfate-derived acids. While this statement may be challenged on scientific grounds, and inaccurately describes the conclusions of the text of the report, nevertheless the imprimatur of the National Academy of Sciences must be taken with the utmost seriousness. The statement of the White House scientific panel underscores the weight which the Academy's views must be accorded.

The Reagan Administration, which previously supported only accelerated acid rain research efforts, is now in the process of revising its position. The Administration is expected to propose legislation in early September which is likely to include substantial reductions in SO_2 emissions.

Thus, the acid rain debate now increasingly centers on how, not whether, to structure an acid rain control program. The Task Force believes that, if current predictions regarding the time frame within which legislation will be formulated are correct, public power systems have a vital opportunity now to participate in the design of legislation.

Acting upon that opportunity is made more urgent by the serious deficiencies which the Task Force believes most current bills contain. Public power systems have a responsibility to participate in the formulation of legislation to ensure that its provisions meet reasonable standards of effectiveness, economy, and equity within the framework of present scientific understanding.

APPA's policy resolution on acid rain control legislation sets these standards as criteria against which legislation should be evaluated. APPA's resolution also notes that many pending legislative proposals "would impose emission cuts exclusively on electric powerplants without regard to: other stationary or mobile source contributions; total cost; relative cost-effectiveness of different emission reduction measures; ascertainable benefits; and equitable distribution of cost burdens...."

If the present opportunity to participate in the design of legislation is foregone, then the program finally enacted may fail, by default, to meet the essential standards set out in Association policy.

Therefore, by unanimous vote on August 11, the Special Task Force on Acid Rain adopted a series of recommendations regarding acid precipitation control legislation as detailed in Part III of this report.

The Task Force has endeavored to ensure that the positions supported in this report meet the criteria for acid precipitation control legislation which are set out in the Association's policy resolution approved by the general membership on May 3, 1983. The positions of the Task Force are not intended to constitute a comprehensive legislative proposal. For example, the Task Force does not attempt to resolve such issues as the extent to which emissions should be reduced or the time frame within which such reductions should occur, although Task Force members concur that initial reductions should be moderate and the time frame adopted should not require exorbitant annual taxation levels. Instead, the positions are intended to serve as a set of coherent principles for legislation.

III. Recommendations for Acid Precipitation Control Legislation

The Task Force proposes 10 specific elements of a legislative program. These proposals and the rationale for their adoption follow:

1. *A nationwide sulfur dioxide and nitrogen oxide emissions tax should be applied to all fossil-fueled sources for which an emissions tax is feasible.*

This is the most far-reaching of the Task Force's recommendations. It specifies a taxing mechanism, its geographic applicability, the pollutants to be taxed, and the source categories to which the tax is to be applied.

The Task Force rejects schemes without financing (or "cost-sharing") mechanisms, as embodied in last year's Senate Environment and Public Works Committee acid rain proposal. There are a number of reasons to reject legislative approaches which do not contain financing mechanisms. They include the large uncertainties associated with the eventual capital requirements of an "open-ended cost" bill; the prospect of drastic impacts on the economies of several already distressed states, as well as upon individual utilities; the political unacceptability of such impacts; and the implicit, but unavoidable, assumption that long-range transport is the dominant mechanism leading to acid deposition.

Three cost-sharing schemes were investigated in detail:

- kWh tax;
- Btu tax;
- emissions tax.

One of the leading proposals being considered in Congress at the present time is the Sikorski/Waxman bill (H.R. 3400), which would impose a 1 mill per kilowatthour fee on all non-nuclear electric generation, including hydroelectric generation. Senator John Glenn (D-OH) has proposed a 3 mill per kilowatthour fee on fossil fuel generation in a 31-state region. While the Task Force recognizes the administrative simplicity of a kWh tax, it rejects an electricity tax because it unfairly targets utility customers to pay all control costs. Further, an electricity tax does not recognize or credit emission reductions already achieved by individual utilities and their ongoing costs to ratepayers; nor does it provide incentives for future cleanup. The problem is not the consumption of kilowatthours, but the emission of pollutants that can lead to acid precipitation.

A Btu tax -- either at point of sale or as a levy on energy inputs to boilers, industrial processes, or other combustion sources -- is disadvantageous for some of the same reasons: it neither credits emission reductions achieved nor gives incentives to reduce emissions. In addition, a Btu tax would account inadequately for emissions from nonferrous smelters -- where significant emissions result from sulfur in the ore and not in the fuel -- and would be administratively complex.

After detailed evaluation, the Task Force supports an emissions tax as the best available alternative: (1) it fairly apportions the tax liability to those sources contributing most to the precursors causing acid rain; (2) it credits past cleanup; and (3) it provides incentives for emissions reductions, since any reduction will reduce tax liability. An emissions tax best addresses the sources of acid rain in a manner which is economically efficient.

Though substantial attention has been given to regional application of the tax, the Task Force concurs that a nationwide tax is preferable. First, a regional tax may be unconstitutional (Article I, Section 8, of the U.S. Constitution states that all "Duties, Imposts and Excises shall be uniform throughout the United States."). Also, although the Task Force's consensus was that costs of cleanup should be borne by emitting sources insofar as reasonably possible, the Task Force appreciates that there is substantial political opposition to strict application of this principle and that the already economically distressed industrial Midwest could face unacceptable additional burdens.

Other facts as well support a nationwide approach. Foremost among these is scientific evidence that areas throughout the United States may be sensitive to effects from acid deposition, and that acid deposition has been documented in many states outside the Northeast. Finally, a nationwide approach avoids drawing arbitrary boundary lines between those who do and do not pay a tax.

The Task Force supports an emissions tax on both sulfur dioxides and nitrogen oxides. Tax applicability to both is based on the strong scientific evidence that both SO_2 and NO_x contribute to acid deposition.

The Task Force agrees with the scientific evidence that all fossil fuel combustion can create precursors to acid deposition, and therefore recommends that SO_2 and NO_x emissions from all fossil fuel sources should be liable to the tax so long as it is feasible. Source categories specifically include cars and trucks, smelters, industrial boilers, industrial processes, and utility boilers. The caveat, a test of "feasibility," is included to account for the potential difficulty of applying an emissions tax to many small stationary sources or to the nation's existing population of cars and trucks. Note, however, that all fossil fuel sources should be included in initial consideration for taxation, and should be excluded only if an emissions tax is shown to be infeasible to administer.

2. *The fund derived from the tax should be employed to finance verifiable emission reduction measures.*

Funds raised should be applied to measures (not merely "technologies" like scrubbers) which will reduce emissions in accordance with the reduction goals to be specified in legislation. The Task Force specifically recognizes the following SO_2 emission control measures: 1) fuel switching; 2) fuels pre-treatment, including physical coal cleaning, chemical coal cleaning, and oil desulfurization; 3) flue-gas desulfurization systems (scrubbers) on nonferrous smelters, industrial and utility boilers, and other industrial processes; and 4) any other emission reduction measure now under development whose performance can be verified during the term of the program. The Task Force considered a recommendation to set aside a portion of the fund for the demonstration of advanced pollution control or energy-efficient technologies, but chose not to adopt a position because support for demonstration of such technologies may best be considered in EPA or DOE appropriations.

3. *The purchase of emission reduction measures should not be mandated in excess of the monies available in the fund.*

Sometimes described as a "clean as you pay" strategy, this requirement would ensure that legislation promises no greater reduction in emissions than can realistically be achieved by the fund. By keying emission reductions to the funds available, sources required to reduce emissions at the end of the program are assured of having the same financing support as sources required to reduce emissions at the beginning of the program. This provision would keep the legislation honest. In practical terms, this recommendation means that the financing program would remain in effect until emission reduction goals are met, and would not expire at an arbitrary date. Also, this provision would require that the cost of the program be acknowledged at the program's inception, thereby setting a cap in any given year on the national expenditures devoted to address the acid rain problem.

4. *The fund should be applied to the capital costs of the control measures chosen.*

Under various financing schemes, either capital costs or operation and maintenance costs -- or percentages of both -- have been considered for eligibility to receive funding. Because of the potential difficulties in raising the large amounts of capital which may be required for individual sources mandated for control measures, the Task Force supports their application to capital costs only. In instances where scrubbers may be mandated, capital costs are roughly equivalent to operation and maintenance costs over the lifetime of a facility. While the Task Force is fully aware that operation and maintenance costs could be a significant cost burden for those mandated to install controls -- particularly for many large sources in the industrial Midwest -- the Task Force also recognizes that this cost burden would be lessened somewhat by the decrease in the emissions tax which would accompany an emissions reduction program at individual facilities.

In those instances where fuel pre-treatment may be the mandated emission control measure, the Task Force supports the use of monies in the fund for installing additional capacity for treatment as necessary. Fuel pre-treatment specifically includes coal cleaning and oil desulfurization.

Fuel switching often entails capital costs. For example, precipitator redesign or the use of baghouses may be required when switching to low sulfur coal. Such costs would obviously be covered under the fund. When fuel switching does not involve capital costs, no monies would be made available from the fund, though any higher costs associated with using premium low sulfur fuels would be somewhat compensated by lower emission tax liability.

5. *Emission reduction measures for stationary sources should be selected in order of cost-effectiveness, including consideration of the remaining useful life of facilities, with allowance made for administrative consideration of the likelihood of reducing impact in sensitive receptor areas.*

Since the Task Force lacks expertise in emission reduction measures which may be feasible for mobile sources such as cars and trucks, the Task Force is silent on the question of mobile source control. For stationary sources, however, the Task Force emphatically supports pursuit of control measures which give the "biggest bang for the buck" -- achieve the largest possible reductions at the lowest possible cost. Not only is this cost-effectiveness criterion the most economically efficient approach, but, in the absence of definitive identification of source-to-receptor relationships, it best responds to scientific uncertainties.

Though not specifically addressed in this recommendation, the consensus of the Task Force is that both SO_2 and NO_x emission reductions should be eligible for financing, but that NO_x reductions should be discretionary and creditable to overall SO_2 emission reduction goals. Thus, for example, lowering excess air in boilers to reduce NO_x would not be mandated, but individual sources could receive funding to install low NO_x burners should they be found cost-effective.

The Task Force urges that cost-effectiveness judgments on control measures weigh: the site-specific factors limiting the practicability of retrofit of control measures; operation and maintenance costs; capital costs; and the useful remaining lifetime of the facility receiving control. In essence, this clause stipulates application of a life-cycle method of costing to individual facilities.

In many cases, fuel switching may be the most cost-effective control measure. Task Force members are unanimous in supporting fuel switching as an option to reduce emissions. The Task Force is aware, however, that political, not economic, parameters may eliminate fuel switching as a permissible control option.

The Task Force notes that application of a cost-effectiveness standard would benefit the nation with costs at least 25 percent lower than those entailed by approaches which rely on "continuous emission reduction technologies" (that is, scrubbers).

Consideration of the "likelihood of reducing impact in sensitive receptor areas" provides for some form of targeting emission reductions to either particular regions or to particular emission sources should scientific evidence so warrant.

6. *The emission reduction program should be divided into two phases, with the second phase to take effect contingent upon affirmative congressional action, including findings that the program is achieving its objectives.*

This proposal takes account of three facts central to the acid rain dilemma. First, present scientific data have yet to determine adequately the extent of damage from acid rain, the rate at which that damage is occurring, and the individual sources that may be causing such damage. Second, legislation to address acid rain is likely to impose a formidable cost burden on the nation. And third, scientific evidence in the years to come may allow fine-tuning of the emission reduction program. By requiring affirmative action by the Congress to proceed with a second phase, the practical result is to allow for mid-course review and correction. Also, by setting emission reduction goals in two phases, a greater incentive results to reduce the cheapest emissions first, thereby bolstering a cost-effectiveness approach.

7. *The program enacted should provide for adequate monitoring and continued research to gauge the effectiveness of the emission reduction program.*

Obviously, for mid-course review and correction to be possible, additional information on the effects of measures taken must be available. This recommendation assures that the national resources expended on acid rain controls are in fact achieving their objectives. The Task Force urges strongly that an adequate monitoring program be established which could demonstrate a decrease in the impact of acid rain or in the acidity of deposition to justify the substantial monies expended.

In addition, the Task Force strongly supports the acid rain research efforts presently underway, and urges stepped up efforts in a number of key areas of scientific uncertainty. Foremost among these areas is the role of natural acidification from humic or other organic acids in disturbed habitats. The Task Force also believes that the present debate over the role of local sources vs. long-distance sources needs to be refined in the context of the contributions to acid rain from burning different fossil fuels; specifically, does oil combustion have a greater likelihood of adverse impact than coal combustion? Finally, the Task Force believes greater attention should be paid to the rate at which damage from acid rain is occurring, determinations which would be assisted by more extensive ice-core sampling and controlled field experiments. These recommendations are in addition to the excellent recommendations for additional research made in the recent National Academy of Sciences report.

8. *Emission taxes on stationary sources should be based on actual rather than allowable emissions.*

Many industrial and utility sources do not operate full-time. For these sources, tax liability should reflect their actual contribution to the problem -- that is, actual emissions.

The Task Force addresses this recommendation only to the case of stationary sources. It may be necessary and practical to tax mobile sources on expected -- rather than actual -- emissions. For example, new automobiles could be taxed at point of sale based on measured emissions per mile over their expected lifetime.

9. *No requirements for offsets for new facilities should be included in the emission reduction program.*

Like the policy above which stipulates that control funds expended should not exceed the emission tax collected, this provision would keep legislation honest. For example, emission reduction goals which do not account for future growth underestimate the total reductions required. When such underestimates occur, new sources are forced to find additional emission reductions from existing sources in order not to exceed emission ceilings. Yet, the existing sources from which these "offsets" must be obtained may be the very same sources that are being required to reduce emissions under the general provisions of the reduction program. Thus, not only would offsets be scarce and difficult to obtain, but they would also be extremely expensive. Under this scenario, it is also likely that small sources would be placed at a competitive disadvantage in buying offsets.

Therefore, any emission reduction goals stipulated in legislation should properly account for future growth. Furthermore, the Task Force is skeptical about the viability of the emissions trading or offset approaches that have been advanced in acid rain proposals.

10. *Electric utilities should have discretion to include their contribution to the emissions tax as a line item on utility bills.*

Given the large overall costs, and disproportionately larger costs for specific utilities, of an emissions reduction program, the Task Force supports discretion to utilities to specify to their consumers why electric rates may be rising.

Respectfully submitted,

Dan Waters
Los Angeles Department
of Water and Power
Chairman, APPA Special Task Force on Acid Rain

August 19, 1983

Mr. WAXMAN. Thank you very much, Mr. Radio. I want to commend you on that excellent presentation.

I would like to call on Michael Gregerson, acting director, Environmental and Regulatory Activities Department, Northern States Power Co.

STATEMENT OF MICHAEL GREGERSON

Mr. GREGERSON. Good morning, Mr. Chairman, Congressman Sikorski, members of the Staff, Federal legislators, fellow boardmembers, citizens, and fish.

My name is Mike Gregerson. I work for Northern States Power Co. I have agreed to appear before your committee to discuss some of your ideas and comments on your bill H.R. 3400. About 43 percent of NSP's electric generation is produced by major coal plants, ranging in size from 275 megawatts to over 1,400. NSP also operates over 1,500 megawatts of nuclear generation and has a major purchase agreement with the Manitoba hydro-electric system.

NSP's position on acid rain control is not common in the electric utility industry, as other members have stated. We believe that now is the time to begin a series of staged reductions in sulfur dioxide emissions from existing powerplants. This belief is not solely predicated on the popular solution concept that relates acidity to sulfur emissions, but rather on our experience in controlling sulfur dioxide and our belief that sulfur dioxide is a pollutant which can be controlled in a cost effective way.

In 1970 Northern States Power Co. operated seven coal plants with the combined sulfur dioxide emission rate of approximately 235,000 tons. By 1980 we were able to reduce those emissions to about 105,000 tons per year. In 10 years, emissions from these facilities were cut by two-thirds, over a 66-percent reduction.

We estimate that these reductions were accomplished at a pollution control cost of over $300 million to NSP's rate payers.

Northern States Power Co. has strived to be a leader in emission reduction and pollution control technology. Every NSP coal-fired powerplant burns at least 80 percent low-sulfur Western coal. Sherburne County facilities units 1 and 2 burn 100-percent Western coal and employ flue gas desulfurization system known as wet scrubbers. At our Riverside plant in Minneapolis we have two units that are retrofitted with a new technology known as dry scrubbing, combined with a very efficient baghouse filter, the same technology which is to be used at our new Sherburne County 3 facility up in Becker, Minn.

Looking to the future, NSP now plans to develop an experimental fluidized bed combuster at our Black Dog Plant in Burnesville, Minn. We hope that this new technology may provide a method of reducing sulfur dioxide that is less expensive than scrubber systems.

Sulfur dioxide control, which is an important acid rain issue is not our only concern. We believe acid rain control legislation should be effective, achievable and equitable.

We believe effective acid rain legislation must deal with all pollutants which affect rain chemistry and must be national in scope.

Anything less will ignore significant issues in search of political convenience.

Research into the acid rain phenomenon and effective control technology must be strengthened. There has to be more money spent in this area. Simple tonnage or percentage reductions are not realistic or achievable without some implementation plan. We believe sulfur dioxide reductions are best achieved with the emission rate limitations applied to all existing sources on a realistic schedule.

Perhaps the most difficult issue is the one of assuring equitable regulation. We believe that equitable acid rain legislation should give credit for past pollutant reductions and investments in pollution control equipment. Failure to credit past control efforts would strongly discourage any future voluntary reductions.

If the national funding mechanism is required, then a taxation system based on pollutants, not sales, is the most equitable.

This would provide additional economic incentives for all emitters to reduce emissions. We believe that a tax on kilowatt hour sales offers no incentives and no credit for cleanup. In summary, Northern States Power Co. favors acid rain control legislation, including the regulation of existing fossil fuel powerplants. But we believe some major factors must be considered, especially economic and technological feasibility, past investments in pollution control and the fair distribution of costs.

NSP is committed to helping develop good acid rain control legislation. I would like to take this time to thank you for the opportunity to be here and hope that your next visit to Minnesota is a little warmer. Thank you.

[Testimony resumes on p. 264.]

[Mr. Gregerson's prepared statement follows:]

Michael Gregerson
Northern States Power Company
Testimony Before the Health & Environment Subcommittee,
U.S. House of Representatives Energy and Commerce Committee
December 9, 1983

My name is Michael Gregerson. I am Director of the Environmental and Regulatory Activities Department for Northern States Power Company and I have agreed to appear before your committee on acid rain and possible control programs.

Northern States Power Company and its subsidiaries serve an area of nearly 49,000 square miles in parts of Minnesota, Wisconsin, North and South Dakota and Michigan. The Company generates, transmits, and distributes electric power to nearly 1.2 million customers, serves a population of almost 3 million people, and has total assets of approximately 3.2 billion dollars.

About 43 percent of NSP's electric generation is produced by five major coal plants ranging in size from 275 MW to over 1,400 MW. NSP also operates 1550 megawatts of nuclear generation and has a major purchase agreement with the Manitoba hydro-electric system.

ACID RAIN CONTROLS

NSP's position on acid rain control is not common in the electric utility industry. We believe that now is the time to begin a series of staged reductions in sulfur dioxide (SO_2) emissions from existing power plants. This belief is not predicated on the popular concept which relates rain acidity to sulfur emissions, but rather on our experience in controlling sulfur emissions at NSP's facilities, and our belief that sulfur dioxide is an acknowledged pollutant which can be controlled in a cost effective way.

SULFUR DIOXIDE EMISSIONS

In 1970 NSP operated seven coal plants with combined sulfur dioxide emissions of approximately 235,000 tons per year. By 1980, we reduced those emissions to about 105,000 tons per year. In 10 years, emissions from these facilities were cut by two-thirds, a 66 percent reduction. Figures 1 and 2 show the reductions made at each plant and that coal-fired energy production increased over the ten year period while SO_2 emissions decreased. Figures 3 and 4 show 1970 individual plant emission rates, all in excess of 5 lbs/MBtu of heat input to the boiler. For several of the plants emission rates were in excess of 6.0 lbs/MBtu. As Figures 5 and 6 show, by 1980 every facility was at or below 3 lbs/MBtu. NSP's two newest and largest units at Sherburne County operate below 0.7 lbs/MBtu. These major reductions in sulfur dioxide over the entire NSP system result in a present system-wide average emission rate below 1.5 lbs/MBtu. We estimate that these reductions were accomplished at a pollution control cost of over 300 million dollars to NSP's rate payers.

NSP has strived to be a leader in emission reduction and pollution control technology. Every NSP coal-fired power plant burns at least 80 percent low-sulfur Western coal. Sherburne Country Units 1 and 2 burn 100 percent low sulfur coal and employ flue gas desulfurization systems known as "wet scrubbers." These scrubbers reduce sulfur dioxide by 60 to 70 percent and remove 99 percent of the particles. At NSP's Riverside Plant, Units 6 and 7 have been retrofitted with a new technology known as "dry scrubbing", reducing sulfur dioxide concentrations by 70 to 80 percent combined with a very efficient baghouse filer.

Looking to the future, NSP plans to develop an experimental fluidized bed combuster at its Black Dog Plant. This new technology may provide a method of reducing sulfur dioxide that is less expensive than scrubber type systems. We also began construction in August, 1983 on Sherco 3, our newest coal plant which is jointly owned with two municipal power agencies in Minnesota. This unit will be NSP's largest and cleanest coal-fired power plant employing latest control technology. Sherco 3 will use a dry scrubbing system and bag house filters to reduce emissions to extremely low levels, and operate at conditons more restrictive than Federal New Source Performance Standards.

NSP's use of a variety of sulfur dioxide control methods has resulted in substantial reductions in sulfur emissions over the last decade.

CONTROL PROPOSALS

Sulfur dioxide control, while an important acid rain issue, is not the only concern. We believe acid rain control legislation must be more than mandated sulfur reductions. Legislation should address all the issues surrounding acid rain: reasonable legislation must be effective, achievable and equitable.

Effective

Effective acid rain legislation must deal with all pollutants which affect rain chemistry, and must be national in scope. Anything less will ignore significant issues in search of political convenience. Oil and gas electrical capacity and mobile sources of pollution must be considered. Research into the acid rain phenomenon and effective control technology must be strengthened.

Achievable

Simple tonnage or percentage reductions are not realistic or achievable without some implementation plan. We believe SO_2 reductions are best achieved with emission rate limitations applied to all existing sources on a realistic schedule.

Equitable

Perhaps most difficult is the issue of assuring equitable regulation. We believe that equitable acid rain legislation should give credit for past pollutant reductions and investments in pollution control. Failure to credit past control efforts would strongly discourage any future voluntary reductions. While we also believe that pollutant sources should take their own steps to reduce emissions, economic impacts of control requirements may be substantial. If a national funding mechanism is required, then a taxation system based on pollutants, not sales, is the more equitable. Sources which have already paid for major pollutant reductions will benefit by their efforts, and those that haven't will be encouraged to do so. There has to be additional economic incentives for all emitters to reduce emissions.

CONCLUSION

NSP favors acid rain control legislation, including the regulation of existing fossil fuel power plants. But we believe many factors must be considered, including other pollutant sources, economics and technological feasibility, past investments in pollution control, regional differences in pollutant emissions, and the fair distribution of costs.

We believe that any legislation should be based on the following concept:

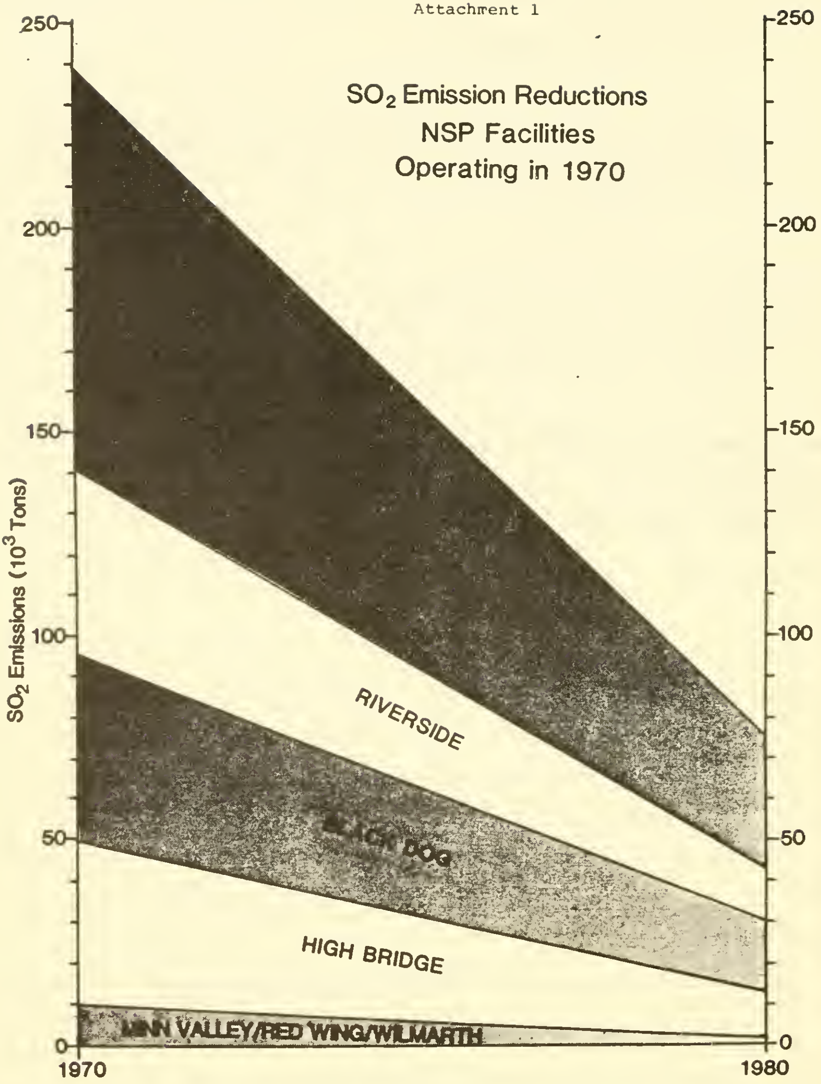
1. Credit for those emitters who have made major investments in pollution control technology.

2. A taxing method which provides incentives to reduce emissions and does not force low polllution emitters to subsidize other areas of the country.

3. Phased SO_2 reductions to allow some utilities to gain experience with scrubbers and other emission reduction processes on smaller facilities.

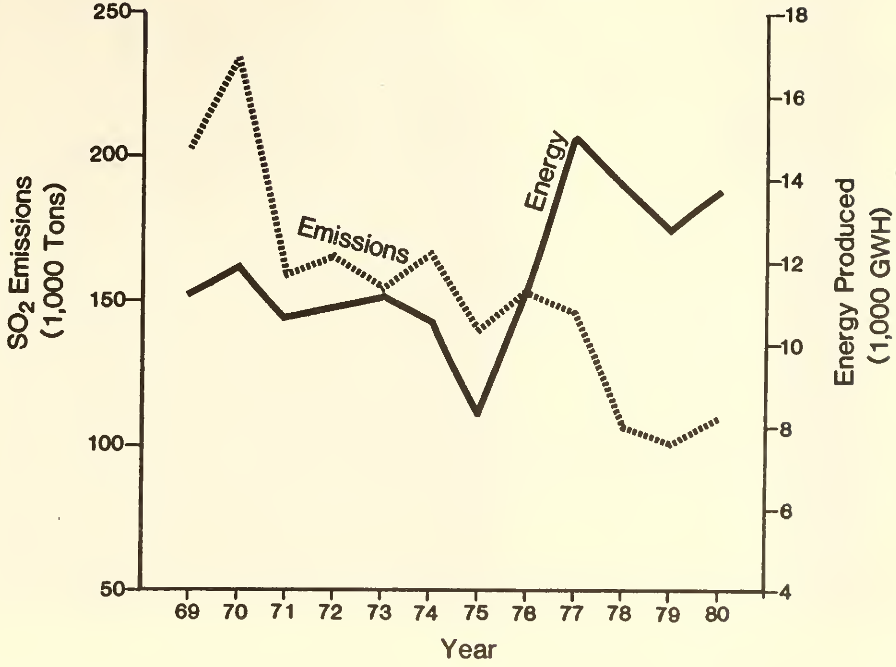
NSP is committed to helping develop good acid rain control legislation. Thank you for this opportunity to present some of our ideas before your committee.

Attachment 1

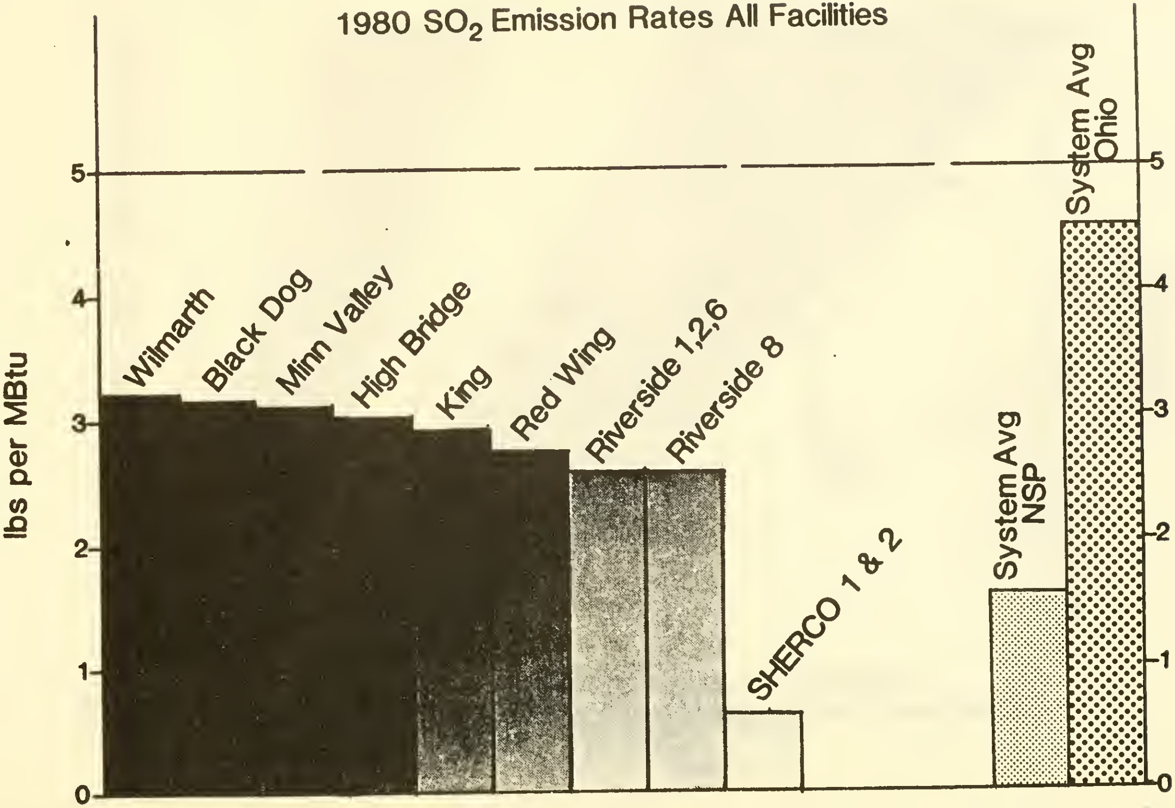


Attachment 2

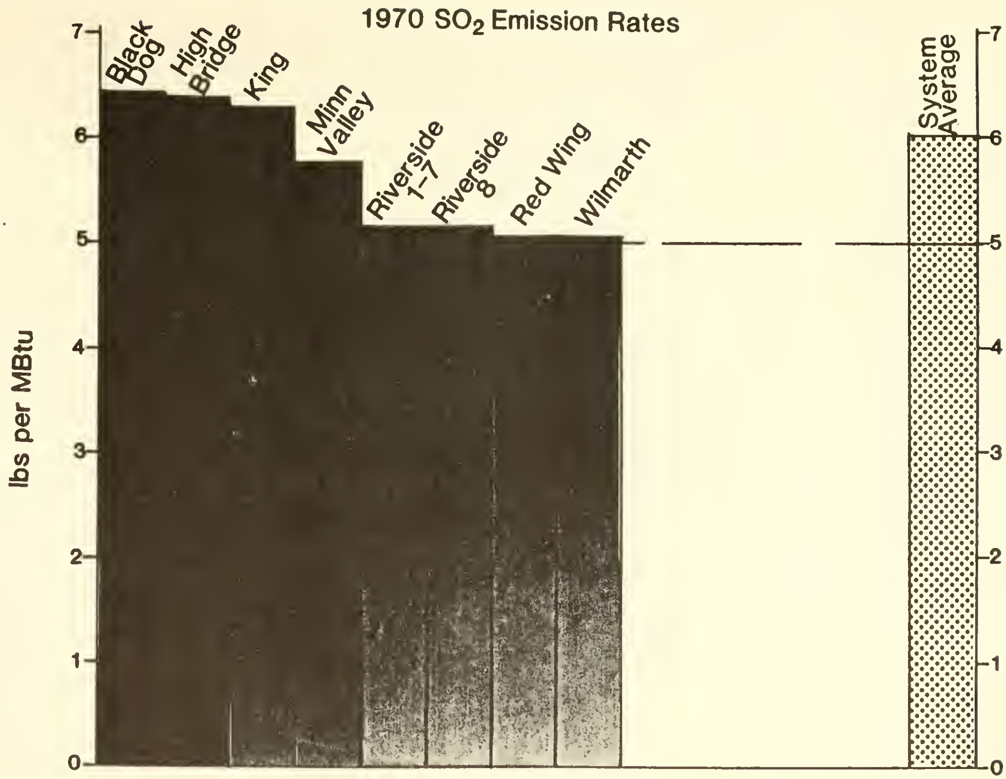
Historical SO_2 Emissions and Energy Production from NSP's Coal-fired Generation



Attachment 4



1980 SO_2 Emission Rates All Facilities


1970 SO$_2$ Emission Rates
lbs per MBtu
0
1
2
3
4
5
6
7
Black Dog
High Bridge
King
Minn Valley
Riverside 1–7
Riverside 8
Red Wing
Wilmarth
System Average

Attachment 5

COAL FIRED SYSTEM EMISSION COMPARISON

NSP (1970)

PLANT	RATE	ACTUAL TONS/YR
Black Dog	6.38	44,300
High Bridge	6.34	41,100
King	6.26	97,000
Riverside 1-7	5.14	12,600
Riverside 8	5.14	33,900
MN Valley	5.74	4,240
Red Wing	5.06	1,750
Wilmarth	5.06	1,140

Average Rate	6.01 lbs/MBtu - 21.1 tons/net GWh
Total Tons	236,000
Generation	11,170 GWh

Attachment 6

COAL FIRED SYSTEM EMISSION COMPARISON

NSP (1980)

Plant	Rate	Actual Tons/Yr	Control
Black Dog	3.17	13,500	80% Low S coal
High Bridge	3.02	15,800	80% Low S coal
King	2.89	32,300	80% Low S coal
Riverside 1, 2, 6	2.58	2,600	80% Low S coal and Dry Scrubber
Riverside 8	2.58	11,200	80% Low S coal
Sherco 1 & 2	0.67	28,500	100% Low S coal and Wet Scrubber
MN Valley	3.11	600	80% Low S coal
Red Wing	2.71	350	80% Low S coal
Wilmarth	3.23	340	80% Low S coal

Average Rate	1.53 lbs/MBtu - 7.71 tons/net GWh
Total Tons	105,200
Generation	13,640

Mr. WAXMAN. Thank you very much. I would like to hear from Barbara Hughes, managing director of the American Lung Association.

STATEMENT OF BARBARA L. HUGHES

Ms. HUGHES. Thank you, Mr. Chairman, and Mr. Sikorski. I am Barbara Hughes, and I am representing the American Lung Associations in Minnesota. There are three of them.

I have both written testimony and a couple of reports that I would like to submit for the record. I am going to deviate a little bit in terms of our comments because we are going to deal primarily with health effects. You will hear less about acid rain control here.

The Lung Associations in Minnesota support a comprehensive approach to reauthorizing the Clean Air Act, including provision for acid rain deposition controls because we believe there are both health and environmental reasons to do that.

We urge Congress to act very promptly since we believe there is some urgency to protecting public health. To document this sense of urgency I am submitting a report prepared by the epidemiology and statistics unit in the Division of Medical Affairs of the American Lung Association, and you have that report. It is entitled, "Populations at Risk of Adverse Health Consequences in Areas Not in Compliance With National Ambient Air Quality Standards," outlined in the Clean Air Act.

Many of these population groups considered at risk are at risk from sulfur dioxide. The report presents a data base estimating the magnitude of the population at risk and are exposed to ambient air pollution in communities that did not meet the ambient air quality standards by February of 1982, and that reside in areas projected as being unlikely to meet them as of the end of 1982.

That report estimated that there were 48 million American in 111 communities, including some in Minnesota, which were still exposed to unhealthy air by the end of December 1982. That number is 20 percent of the U.S. population, even though we have had more than a decade of clean up activities.

The numbers in the report probably overstate the situation in Minnesota at this present time in terms of the health effects. However, there still are areas designated non attainment here for carbon monoxide, particulates, as well as sulfur oxides. The report details the type of health risks faced by various groups, including children under 2 years old, patients with chronic health disease, heart disease, pregnant women and the elderly.

The second report that I have asked to be introduced is entitled "Sulfur Oxides and Public Health, Evidence of Greater Risks." It also was prepared by the American Lung Association and the American Thoracic Society. The report deals with the health research about sulfur dioxide and its transformation products. As you know, sulfur dioxide in the air acts over time to form sulfuric acid and other sulfate salts.

Sulfuric acid is extremely reactive. Both it and SO_2 have been found to impede the respiratory system's ability to clean itself of foreign matter and to impair breathing function in laboratory subjects. Brief laboratory exposure to sulfate particulates at concentrations as low as 100 micrograms per cubic meter has likewise shown effects on airway resistance and respiratory volume.

For these reasons, the Lung Associations in Minnesota support programs to achieve significant reductions of sulfur oxides from major stationary sources as a way to control both SO_2 and transformation products. Such reductions have benefits, as we see them, of reducing not only an environmental health threat in acid deposition, but also of reducing a public health risks. While SO_2 reductions can be achieved through separate acid rain control legislation, we also would like you to consider incorporating them in provisions of the Clean Air Act.

Our written testimony which accompanies these two reports outlines other reasons for urging prompt and comprehensive reauthorization of the Clean Air Act. We feel that in Minnesota we need the new Act to get faster action on controlling hazardous air pollutants, a way to develop meaningful economic penalties to encourage states and localities to move ahead in achieving healthy air, and to get standards and deadlines for diesel emissions from cars and trucks.

There are other reasons we want you to hurry and reauthorize the act, including maintaining the current method of studying health standards, maintaining specific deadlines for meeting air quality standards, and keeping provisions that reduce pollution, while allowing for economic growth.

We also want you to continue to control other related pollution by maintaining the emissions standards and deadlines, because without these provisions much of the progress in Minnesota communities would be lost. Obviously, we have a strong emphasis on control of sulfur dioxide from major sources. The Lung Association has participated in State sulfur dioxide standard setting hearings that lasted about a couple of years.

The testimony there revolved around a lot of the health and environmental consequences, much of the same sort of thing you heard here. The research that is detailed in the sulfur oxide paper was used heavily in that.

We adopted, in Minnesota, standards that gave us both environmental protection and health protection. We urge you, the Congress, to do likewise.

Thank you so much for letting us testify.

[Testimony resumes on p. 337.]

[Ms. Hughes' prepared statement and attachments follow:]

TESTIMONY FOR THE HOUSE OF REPRESENTATIVES SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT

DECEMBER 9, 1983, ST PAUL, MN

The American Lung Associations of Hennepin County, Ramsey County and Minnesota support a comprehensive reauthorization of the Clean Air Act. We want to emphasize several points which are vital to the respiratory health of Minnesotans when considering reauthorization:

1. maintain the current method of setting health related standards with an adequate margin of safety,
2. require standards with an adequate margin of safety for hazardous air pollutants,
3. reduce emissions of sulfur oxides from major stationary sources to control both sulfur oxides and their transformation products (particulate sulfates).

Minnesota communities meet most air quality standards, but without continued requirements to meet auto emission standards some communities could face public health problems. Further, since Minnesota has worked diligently to meet air quality standards, we believe other regions should be required to meet standards in a timely manner. We therefore believe that when reauthorizing the Clean Air Act Congress should

4. maintain specific deadlines for meeting air quality standards,
5. keep provisions of the current Act that reduce pollution levels while allowing for economic growth,
6. develop meaningful economic penalties to encourage states and localities to move ahead in achieving healthful air quality,
7. continue to control auto-related pollution by maintaining emission standards and deadlines, and
8. develop diesel emission standards and deadlines for automobiles and trucks.

Clean Air Health Standards

The American Lung Associations of Hennepin County, Ramsey County and Minnesota firmly support the principle that the health related National Ambient Air Quality Standards be designed specifically to protect the health of children, the chronically ill, and the elderly, and they should be set so as to provide an adequate margin of safety in the face of scientific uncertainties.

The American Lung Associations of Hennepin County, Ramsey County and Minnesota believe that the costs of attaining a primary ambient air quality standard should be considered only in developing pollution control strategies and in determining a timetable for the steps of attainment, not in developing health-protecting standards.

Hazardous Air Pollutants

The Clean Air Act authorizes EPA to set emission limits on hazardous air pollutants - those for which there are no ambient air quality standards, but which can cause death or serious illness. Of the hundreds of hazardous substances emitted into the air, EPA has so far issued standards for only a small number.

The American Lung Associations of Hennepin County, Ramsey County and Minnesota believe the Clean Air Act should set deadlines to speed EPA's development of emission limits and standards for these potentially dangerous air pollutants. The use of state-of-the-art emission controls for hazardous pollutants can be accomplished at reasonable cost. In some cases, fully protecting public health will be possible immediately by substituting a safe chemical for the hazardous one, or by totally enclosing polluting processes. Where these options are not feasible, the best control technology now available should be required.

Congress should pursue the goal of protecting public health with an ample margin of safety from these pollutants while recognizing that protecting the public's health does not necessarily require eliminating all risks regardless of cost.

Sulfur Oxides and Acid Sulphates

We agree with the American Lung Association and the American Thoracic Society position outlined in the white paper, "Sulfur Oxides and Public Health: Evidence of Greater Risks". If acid rain control legislation mandates reductions in emissions of sulfur dioxide it would have two benefits:

1. reduction of an environmental threat, and
2. reduction of public health risks.

The American Lung Associations in Minnesota believe emissions of sulphur oxides can be transformed in the atmosphere into particulate sulfates, inhalation of which has been shown to be hazardous to the lung. Current control programs generally require only limited consideration of the effects of long-range transport. Available information suggests reductions in emissions of sulfur oxides would result in reductions in the levels of these fine particulates. Therefore, the American Lung Associations support programs to achieve significant reductions in sulfur oxides from major stationary sources.

The emissions of sulfur-bearing compounds from burning coal and oil need to be controlled more effectively. These pollutants remain airborne for long periods of time and may travel great distances, creating high concentrations far from emission sources. Atmospheric levels of sulfur dioxide, sulfuric acid and sulfates are high enough in some areas of the United States to be harmful to the public.

Sulfur dioxide is the main sulfur product of combustion. Sulfur dioxide itself is toxic. In laboratory tests, exposure to the gas for less than one hour at concentrations of 0.25 to 0.5 ppm was found to constrict the respiratory airways of asthmatics and also to cause wheezing and shortness of breath. Normal subjects have also shown respiratory symptoms when exposed to sulfur dioxide, but at higher concentrations.

In the air, sulfur dioxide reacts overtime to form sulfuric acid and other sulfate salts. Sulfuric acid is an extremely reactive substance which, like sulfur dioxide, has been found to impede the respiratory system's ability to clear itself of foreign matter and to impair breathing functions in laboratory subjects. Brief exposure to sulfate particles at concentrations as low as 100 ug/m^3 has likewise shown effects on airway resistance and respiratory volume. In the ambient air, actual exposure may be much longer, since elevated sulfate levels can persist for 12 hours a day.

Combinations of sulfur oxides, ozone, and other major pollutants may be more hazardous than each of these substances alone - laboratory tests have not resolved the question. However, a number of epidemiological studies show clear evidence of increased sickness and mortality in the population at large caused by elevated concentrations of sulfur dioxide and particulate matter in the ambient air. On a national scale, at high pollution levels, fractional increases in sulfur dioxide and sulfate concentrations may well take an increasing toll in illness and death, particularly among the elderly, persons with respiratory and cardiovascular disease, and other susceptible individuals.

A copy of the ALA/ATS white paper, "Sulfur Oxides and Public Health: Evidence of Greater Risks" is enclosed to further document the need for SO_2 control.

Populations at Risk

A copy of the report "Populations at Risk of Adverse Health Consequences in Areas Not in Compliance with National Ambient Air Quality Standards (NAAQS) of the Clean Air Act" prepared by the Epidemology and Statistics Unit, Division of Medical Affairs, American Lung Association, is enclosed.

The report provides a data base estimating the magnitude of the populations at risk and exposed to ambient air pollution in communities not meeting NAAQS by February 1982 and further estimates populations residing in areas projected as unlikely to meet NAAQS by the end of 1982 for total suspended particulates, nitrogen oxides and sulfur dioxide and by December 31, 1987 for carbon monoxide and ozone.

The statistics are presented for

1) pediatric population less than two years of age,
2) pregnant women,
3) patients with asthma, chronic bronchitis, and emphysema,
4) patients with a history of myocardial infarction, agnina pectoris and other forms of coronary artery disease,
5) persons 65 years of age and older.

The statistics presented for Minnesota are estimated for just portions of the counties listed which were not expected to meet ambient air quality standards for certain dates.

The pediatric population is particularly susceptible to ambient air pollution due to exposure to respiratory irritants during exercise and their inhalation of greater volumes of air per surface area of the lungs compared with adults. During exercise out-of-doors, children breathe greater amounts of air pollutants by mouth inhalation. At rest, nasal breathing reduces the quantity of pollutants inhaled into the lungs by filtration of large particles. In children under two years of age, the ability to protect the lungs against foreign particles and gases is not fully developed, increasing the risk of lower respiratory tract infection.

In patients with chronic lung disease, exposure to respiratory irritants in ambient air increases the severity of shortness of breath upon exertion and may trigger bronchoconstriction in patients with asthma and emphysema. Acute exascerbation of chronic bronchitis may follow inhalation of irritants in ambient air.

Chest pain and exertional dyspnea experienced by patients with a history of heart attack and angina pectoris are made worse by exposure to levels of carbon monoxide in excess of federal health standards specified by the NAAQS. Patients with other forms of heart disease may be at risk of complication due to reduced oxygen availability during episodes of excess ambient CO.

Pregnant women are considered to have higher risk for reacting adversely to the air pollutants. The risk may be transferred to the developing fetus when carbon monoxide and other constituents in the air inhaled by the mother cross the placenta. Such exposure may increase the fetal risk of hypoxia (3) and growth retardation. Although the primary source of this exposure is cigarette smoke, the contribution of ambient CO must be considered to add incrementally to the risk of hypoxia in both smoker and non-smoker.

In the elderly, a decline in the pulmonary defense mechanisms associated with aging lead to a decreased ability to cope with air pollutants and other respiratory irritants.

POPULATIONS AT RISK OF ADVERSE HEALTH CONSEQUENCES IN AREAS NOT IN COMPLIANCE WITH NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) OF CLEAN AIR ACT

A Data Base Estimating The Magnitude Of The Populations At Risk And Exposed To Ambient Air Pollution In Communities Not Meeting NAAQS by February 1982 And Residing In Areas Projected As Unlikely To Meet NAAQS By End Of 1982 For Total Suspended Particulates, Nitrogen Oxides and Sulfur Dioxide and December 31, 1987 For Carbon Monoxide And Ozone.

*****

AMERICAN LUNG ASSOCIATION
Epidemiology And Statistics Unit
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*****

April 26, 1983

This Report And Data Base Updates And Expands An Earlier Release Entitled:
Chronic Lung Disease And Populations At Risk Of Adverse Health Effects In
US Counties Classified As Not Meeting National Ambient Air Quality Standards
As Of August 31, 1981

EXECUTIVE SUMMARY

The data indicate that a significant proportion of the national population with heightened sensitivity to ambient air pollution live in communities which do not meet National Ambient Air Quality Standards and are not likely, in some cases, to comply with such standards for carbon monoxide and ozone through the end of 1987.

The Interpretation Of PAR Data

The populations identified in this report are at-risk when exposed to ambient air pollution by virtue of their medical condition, physiological status, and/or age. Due to their increased sensitivity, they tend to respond adversely to inhalation of ambient air containing levels of pollutants in excess of the public health standards of the NAAQS.

No cause-effect relationship should be inferred from the data presented. The primarily acute responses which may result in the populations-at-risk who reside in communites not in compliance with one or more NAAQS are well-documented. The PAR estimates represent stationary populations projected to reside in each community around the time when the NAAQS designations were published by the USEPA. These cross-sectional estimates are best used to to indicate the size and geographic distribution of each PAR.

The projection techniques used to estimate the PARs for each community produce data which are subject to statistical error which often occurs when scaling national rates of prevalence of medical conditions to local populations whose exposure to risk factors other than ambient air pollution is unknown. However, most extrapolation procedures have unmeasurable error as a less than desirable outcome .

The interpretation of the data must, therefore, take into account limitations of the methodology and the original source of the data base. The source data base used in this report, National Health Interview Survey (NHIS),provides the "best available estimates" of prevalence for the medical conditions included in these projection. Benefits and limitations of this data base are described in full under the **Statistical Methodology** section of the report.

The Rationale For The PAR Study

Section 109 [B1] of the Clean Air Act specifies that the NAAQS must reflect an "adequate margin of safety" to protect persons with special sensitivity to air pollution. The data provided in this Report indicate the expected size of these populations within local jurisdictions.

The PAR estimates are prevalence data and may be used outside of their air conservation applications to indicate the projected magnitude of the major chronic lung diseases in communities included within this Report.

EXECUTIVE SUMMARY

This report was developed to update the expected size of populations-at-risk (PAR) who reside in communities which were not in compliance with one or more National Ambient Air Quality Standard (NAAQS) as identified by the US Environmental Protection Agency (USEPA) as of February 1, 1982 and/or in communities projected as unlikely to meet NAAQS by deadlines specified by the Agency. These deadlines are December 31, 1982 for total suspended particulates, sulfur dioxide, and oxides of nitrogen and December 31, 1987 for carbon monoxide and ozone.

The February 3, 1983 Data Base

Overall, 46 million Americans (19.8 percent of the national population) live in communities projected as unlikely to meet NAAQS by USEPA deadlines. Total PAR estimates for the 111 communities in this category are presented in Table 1. The proportional contribution of each PAR estimate to the national total is given in parentheses. In this context, communities represent cities, towns and/or other subdivisions of US counties.

The February 1, 1982 Data Base

Over 78 million Americans live in the 472 communities designated as not in compliance with one or more NAAQS as of February 1, 1982. This number comprises 33.8 percent of the nation's population in 1982. Estimates of the populations at-risk when exposed to air quality not meeting public health NAAQS were derived for each community; the total values over all 472 communities for each population are listed in the Table 1.

TABLE 1

POPULATIONS AT SPECIAL RISK RESIDING IN 111 COMMUNITIES PROJECTED UNLIKELY TO MEET NATIONAL AMBIENT AIR QUALITY STANDARDS BY USEPA DEADLINES AND IN 472 COMMUNITIES NOT IN COMPLIANCE WITH NAAQS AS OF FEBRUARY, 1982.

POPULATION-AT-RISK	111 COMMUNITIES TOTAL	111 COMMUNITIES PERCENT	472 COMMUNITIES TOTAL	472 COMMUNITIES PERCENT
POPULATION < 2 YEARS	1,699,291	(20)	2,820,694	(33)
PEDIATRIC ASTHMA	807,048	(35)	1,397,278	(60)
ADULT ASTHMA	971,727	(22)	1,673,178	(37)
EMPHYSEMA	480,234	(20)	766,705	(31)
CHRONIC BRONCHITIS	1,253,676	(16)	1,879,404	(24)
POPULATION > 65 YEARS	4,238,944	(17)	6,993,255	(27)
CORONARY ARTERY DISEASE *	126,399	(3)	504,515	(12)
PREGNANT WOMEN *	104,922	(3)	326,169	(9)

PERCENT - Indicates proportional contribution of each PAR estimate to total national at-risk population.

ASTERISK- Calculated for subset of 38 communities not meeting NAAQS for carbon monoxide as of February 1, 1982 and for subset of 14 communities projected as unlikely to comply with this NAAQS by December 31, 1987.

INTRODUCTION

In February 1982, the Environmental Protection Agency's Office of Air Quality Planning and Standards published their listing and maps depicting counties which had not attained National Ambient Air Quality Standards as described in Section 107 of the Clean Air Act [1]. At that time, USEPA identified 472 counties which were not in compliance with public health standards issued for one or more NAAQS.

In February 1983, USEPA proposed to impose penalties or "sanctions" as per the agency's interpretation of the Clean Air Act on 111 counties and/or county subdivisions which USEPA deemed unable to meet the primary NAAQS for total suspended particulates, sulfur dioxide and nitrogen oxides by December 31, 1982, and carbon monoxide and ozone by December 31, 1987. This report uses the 111 areas to estimate the prevalence and geographic distribution of sensitive persons living in communities below standard ambient air quality.

The total population and populations-at-risk projected to live in communities not meeting primary NAAQS have been estimated for areas identified by USEPA in its publications of February 1, 1982 and February 3, 1983. For these communities, the following populations-at-risk are considered:

[1] pediatric population less than two years of age.
[2] pregnant women
[3] patients with asthma, chronic bronchitis, and emphysema
[4] patients with a history of myocardial infarction, angina pectoris and other forms of coronary artery disease.
[5] persons 65 years of age and older

For the Populations-At-Risk specified under [2] and [4], estimates are derived for the subsets of communities not in compliance with the public health NAAQS issued for carbon monoxide. These subsets identify ambient carbon monoxide as the main ambient pollutant of importance to these populations.

I. Populations At Risk

The pediatric population is particularly susceptible to ambient air pollution due to exposure to respiratory irritants during exercise and their inhalation of greater volumes of air per surface area of the lungs compared with adults. During exercise out-of-doors, children breathe greater amounts of air pollutants by mouth inhalation. At rest, nasal breathing reduces the quantity of pollutants inhaled into the lungs by filtration of large particles. In children under two years of age, the ability to protect the lungs against foreign particles and gases is not fully developed, increasing the risk of lower respiratory tract infection.

In patients with chronic lung disease, exposure to respiratory irritants in ambient air increases the severity of shortness of breath upon exertion and may trigger bronchoconstriction in patients with asthma and emphysema. Acute exascerbation of chronic bronchitis may follow inhalation of irritants in ambient air.

Chest pain and exertional dyspnea experienced by patients with a history of heart attack and angina pectoris are made worse by exposure to levels of carbon monoxide in excess of federal health standards specified by the NAAQS. Patients with other forms of heart disease may be at risk of complication due to reduced oxygen availability during episodes of excess ambient CO.

Pregnant women are considered to have higher risk for reacting adversely to the air pollutants. The risk may be transferred to the developing fetus when carbon monoxide and other constituents in the air inhaled by the mother cross the placenta. Such exposure may increase the fetal risk of hypoxia [3] and growth retardation. Although the primary source of this exposure is cigarette smoke, the contribution of ambient CO must be considered to add incrementally to the risk of hypoxia in both smoker and non-smoker.

In the elderly, a decline in the pulmonary defense mechanisms associated with aging lead to a decreased ability to cope with air pollutants and other respiratory irritants.

II. Statistical Methodology

A projection of the prevalence of populations-at-risk was derived for each community not in compliance with one or more NAAQS by the synthetic estimation technique originally developed by the Bureau of the Census.

National rates of prevalence for the medical conditions under study (chronic lung diseases, history of myocardial infarction and angina pectoris) measured in the 1981 cycle of the National Health Interview Survey are applied to the populations enumerated for each community on an age-weighted basis. This computation provides an estimate of expected local prevalence for each PAR in 1982 [4].

Expected estimates of local PAR´s are scaled in direct proportion to the base population and its age distribution. No adjustments are made for other factors which affect local prevalence (e.g.,distribution of cigarette smokers) since the health surveys which obtain such data are rarely conducted on the level of the county or county-subdivision [5].

The population of pregnant women living in each community is derived from the natality rates observed between January-June, 1982 within states which contain one or more areas not in compliance with the NAAQS for carbon monoxide (52 in total). Although prevalence of pregnant women in these communities will approximate the newborn population, the effects of multiple births and fetal loses will tend to increase the range in variability for the PAR of pregnant women derived by this estimation procedure [6].

The estimate of the population less than 2 years of age is based upon the application of the projection of pediatric distribution within each state to the total population enumerated for each contained community. Age distribution for children under two are derived by Cohort-Component Modeling [7] which accounts for migration, natality and infant mortality.

The elderly population at risk estimates were derived by applying the proportion of each state´s population over the age of 64 to the population base enumerated for contained counties or county sub-divisions. Age-specific distributions of the elderly population were obtained by the Cohort-Component Technique described previously.

III. Footnotes

[1] USEPA Office of Air Quality Planning and Standards. Control Programs Op. **Maps Depicting Nonattainment Areas Pursuant To Section 107 of the Clean Air Act -1982.** Publication Number EPA-450/2-82-012 February, 1982

[2] Federal Register 48(24) February 3, 1983. Proposed Rules pp.5005-5021 **Appendix D. Areas Not Anticipated To Meet The Requirements of CAA** The subset of 111 local areas highlighted in this Report were identified from Appendix D's grid under the heading **Unlikely To Attain NAAQS.**

[3] Fetal hemoglobin has a higher affinity for carbon monoxide than it does for maternal hemoglobin, enhancing the hypoxia risk to the fetus from unhealthful levels of carbon monoxide inhaled by the mother from ambient air pollution and cigarettes.

[4] The National Health Interview Survey ascertains the prevalence of reported conditions of "coronary artery disease" rather than the more descriptive "history of myocardial infarction and angina pectoris". However, persons with old and acute heart attacks and angina comprise the largest proportion of the prevalence reported in this category.

Chronic Obstructive Pulmonary Disease (COPD) is not ascertained as a specific medical condition during the NHIS. COPD is a clinical term not generally recognized by the general public. However, this term has been used with increasing frequency by physicians rather than the more common terms "asthma, chronic bronchitis, and emphysema" in classifying chronic airways obstruction. The omission of COPD from the NHIS leads to an underestimation of the true prevalence of this disorder. "Adult Asthma, chronic bronchitis, and emphysema" combined provide a partial indication of the prevalence of chronic airways obstruction. However, this combined category represents our "best available estimate" for application to this Report.

[5] For additional background on the synthetic estimation technique, refer to **Irwin,R. Guide To Local Area Projections** U.S. Bureau of the Census Technical Paper Number 39 (1972).

[6] Live Birth Rates for States were derived from the National Center for Health Statistics **Monthly Vital Statistics Report 31(8). November 30,1982** entitled **Advanced Report- Final Natality Statistics**

[7] **Illustrative Projections Of State Populations By Age, Sex and Race** Population Estimates and Projections Series P 25(796). Issued March 1979 **Cohort Component Modeling.**

ILLUSTRATED KEY FOR INTERPRETATION OF DATA MATRIX

In the data tables which follow, PAR estimates are listed by county or county sub-division in sequential order within each state. For continuity in data presentation, row titles for each geographic area appear on two consecutive pages while the column headings change to reflect the specific data.

Each array of data entered into the table is either highlighted in **boldface** type or appears in standard type format. The **boldfaced** arrays indicate areas that are projected as unlikely to meet NAAQS by December 31, 1982 for total suspended particulates, sulfur dioxide, and/or oxides of nitrogen, and/or December 31, 1987 for ozone and carbon monoxide [1].

The PAR estimates indicate the numbers of persons within each community who are particularly sensitive to ambient pollution by virtue of their medical condition, physiological status, and/or age.

Areas designated as not in compliance with NAAQS public health standards as of February 1, 1982 are entered into the data table in standard type. In certain instances, areas designated in the February 1, 1982 USEPA listing also appear in the February 3, 1983 listing when air quality had not come into compliance with NAAQS between these two dates.

To indicate that only identifiable portions of counties, rather than entire counties, do not comply with NAAQS, an asterisk (*) appears to the right of area name. For these areas,the county subdivision may be metropolitan in character or represent a central city (or township) with its immediate surroundings [2]. These subdivisions were often listed beside the area name.

The data given under **CODE** refer to the specific NAAQS for which the local communities were non-compliant.

As an illustration of how the data table may be interpreted, the array for Los Angeles County, CA will be reviewed. Note that the array states:

PAGE 1 A

	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
LOS ANGELES CO*	**7,477,503**	**357,618**	**109,137**	**156,470**

PAGE 1 B

EMPH	C/BRONCH	65+	CODE
68,531	**170,193**	**29,661**	**TSP, N** O

The total population base along with PAR estimates for the population under two years of age, with pediatric asthma and adult asthma are on page 1A. PAR estimates for emphysema, chronic bronchitis and the population 65+ years appear on page 1B. The last column lists the NAAQS code.

PAR estimates should be quoted individually and should not be added together to form totals since the PAR's overlap to a certain extent, and are not mutually-exclusive.

The asterisk indicates that only portions of Los Angeles County are projected to not meet NAAQS for TSP and N by December 31, 1982. The O which appears in standard type face indicates that Los Angeles County (in its entirety) had been designated not in compliance with the NAAQS for ozone as of February 1, 1982 but would be likely to meet this standard by December 31, 1987.

Estimated PARs for pregnant women and persons with a history of heart attack and other forms of coronary artery disease are listed separately in Tables 3 and 4.

ILLUSTRATED KEY FOR PAR DATA

[1] For each county or county-subdivision not in compliance with NAAQS public health standards, the following key is used to code the criterion pollutants which exceed NAAQS as of February, 1982, and/or are unlikely to meet NAAQS by December 31, 1982 for total suspended particulate, sulfur dioxide and/or oxides of nitrogen and December 31, 1987 for carbon monoxide and ozone. Compliance status for the latter were documented in **Federal Register. Proposed Rules (48) 24 February 3, 1983. Four-Tier Grid.**

Codes are as follows: TSP= Total Suspended Particulate Matter; S= Sulfur Dioxide; N= Oxides Of Nitrogen; C= Carbon Monoxide ; O= Ozone.

When counties (or their sub-divisions) were cited as not likely to meet NAAQS by specified deadlines, the criterion pollutant(s) affected is (are) given in **boldface** type.

[2] When parts of counties were designated as unlikely to meet NAAQS, contact was made with Regional EPA Branch Offices to ascertain the specific portions of counties contributing to the non-compliance designation. In most instances, local contacts reconstructed those portions of each community which approximately represented areas such as cities, incorporated areas, or other county sub-divisions corresponding to a particular configuration of air monitors and/or areas for which designations had been made on the basis of simulation modeling of air quality. With this information obtained, population bases were assigned to such areas and PARs were derived by the techniques outlined under **Statistical Methodology, Section II.**

For further details on the air quality models designed by the EPA and their application to the classification of NAAQS compliance, see [1]**Rhodes, RG Regulatory Application Of Air Quality Simulation Models** Journal of Pollution Control Association 33(3) March, 1983 ,and, [2]**Guidelines On Air Quality Models At The US Environmental Protection Agency** EPA 450/2-78-027 NTIS Publication Number PB-288283. National Technical Information Service, Springfield, VA.

TABLE 2

	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
ALABAMA					
	JEFFERSON	671,324	27,380	11,058	13,660
	MOBILE	364,890	15,324	6,189	7,420
	RUSSELL	47,356	1,988	803	960
ARIZONA					
	AJO *	5,978	239	55	118
	DOUGLAS *	13,058	522	120	260
	HAYDEN *	1,205	48	11	24
	MIAMI *	2,716	109	25	54
	MORENCI *	2,736	109	25	54
	PHEONIX *	789,704	31,588	7,240	15,567
	SAN MANUEL*	5,443	218	50	476
	TUCSON *	330,537	13,221	3,030	6,516
ARKANSAS					
	PULASKI	340,613	12,345	5,378	6,930
CALIFORNIA					
	ALAMEDA	1,105,379	40,869	17,280	23,140
	BUTTE	143,851	5,043	2,132	3,010
	CONTRA COSTA	656,380	23,236	9,883	13,740
	FRESNO	514,621	18,135	7,668	10,770
	IMPERIAL	92,110	3,451	1,459	1,930
	KINGS	73,738	2,673	835	1,540
	LOS ANGELES	7,477,503	257,618	109,137	156,470
	MADERA	63,116	1,971	834	1,310
	MARIN	222,568	8,442	3,570	4,650
	MENDOCINO	66,738	2,375	1,004	1,400
	MERCED	134,560	4,827	2,004	2,820
	MONTEREY	290,444	10,659	4,507	6,080
	NAPA	99,199	3,548	1,501	2,070

AREA	EMPHYS	C/BRONCH	65+	CODE
ALABAMA				
JEFFERSON*	6,406	15,411	2,976	TSP, O
MOBILE	3,585	8,623	1,666	O
RUSSELL	464	1,118	216	O
ARIZONA				
AJO*	58	203	659	TSP, S
DOUGLAS*	127	442	1436	TSP, S
HAYDEN*	12	40	133	TSP, S
MIAMI*	26	92	299	TSP, S
MORENCI*	26	92	301	TSP, S
PHOENIX*	7,700	26,775	86,867	TSP, O, CO
SAN MANUEL*	58	184	599	S
TUCSON*	3,223	11,208	36,359	TSP, CO
ARKANSAS				
PULASKI	3,642	8,101	1,835	O
CALIFORNIA				
ALAMEDA	6,680	22,009	514	O, CO
BUTTE	1,342	3,332	581	CO
CONTRA COSTA	6,186	15,360	2,679	O, CO
FRESNO*	4,797	11,977	2,062	TSP O
IMPERIAL	917	2,280	397	O
KINGS*	711	1,784	308	TSP O
LOS ANGELES*	68,531	170,193	29,661	TSP, N O
MADERA*	524	1,302	227	TSP, O
MARIN	2,245	3,057	972	O, CO
MENDOCINO	632	1,569	274	TSP, O
MERCED*	1,284	3,189	556	TSP O
MONTEREY	2,835	7,042	1,227	O
NAPA	943	2,344	409	O, CO

	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
CALIFORNIA					
	ORANGE	1,932,709	71,195	130,120	40,450
	SACRAMENTO	783,381	27,670	11,702	16,390
	SAN BENITO	25,005	815	345	520
	SAN DIEGO	1,861,846	66,251	28,012	38,960
	SAN FRANCISCO	678,974	23,277	9,844	14,210
	SAN JOAQUIN	347,342	11,710	4,951	7,270
	SAN MATEO	587,329	21,962	9,286	12,290
	SANTA BARBARA	298,694	10,879	4,600	6,250
	SANTA CLARA	1,295,071	46,652	19,725	27,100
	SANTA CRUZ	188,141	6,566	2,897	3,940
	SOLANO	235,203	7,865	3,326	4,920
	STANISLAUS	265,900	8,868	38,004	5,570
	SUTTER	52,246	1,844	7,602	1,090
	TULARE	245,738	8,344	34,388	5,140
	VENTURA	529,174	18,342	75,585	11,070
	YOLO	113,374	4,103	16,908	2,370
	YUBA	49,733	1,790	73,777	1,050
COLORADO					
	BOULDER	189,625	7,245	2,934	3,900
	DENVER	492,365	17,903	7,249	10,120
	DOUGLAS	25,153	904	366	510
	JEFFERSON	371,753	14,529	5,883	7,640
	MESA	81,530	2,808	1,137	1,680
	PUEBLO	101,686	4,996	882	2,090
CONNECTICUT					
	FAIRFIELD	807,143	27,018	11,795	17,270
	HARTFORD	807,766	26,907	11,746	17,270
	LITCHFIELD	156,769	5,321	2,298	3,350
	MIDDLESEX	129,017	4,298	1,875	2,760
	NEW HAVEN	761,337	25,208	11,005	16,290
	NEW LONDON	238,409	18,674	3,634	5,100
	TOLLAND	114,823	3,776	1,649	2,460
	WINDHAM	92,312	3,077	1,343	1,980

	AREA	EMPHYS	C/BRONCH	65+	CODE
CALIFORNIA					
	ORANGE *	19,122	47,312	8,197	TSP,N,C,O
	SACRAMENTO	10,230	21,700	6,053	O, CO
	SAN BENITO	216	538	94	O
	SAN DIEGO*	**17,622**	**43,768**	**7,627**	**TSP** O
	SAN FRANCISCO	6,192	15,378	2,680	O, CO
	SAN JOAQUIN*	**3,114**	7,912	**1,348**	**TSP, O** CO
	SAN MATEO	5,292	14,459	2,528	O, CO
	SANTA BARBARA*	**2,893**	**7,187**	**1,252**	**TSP** O
	SANTA CLARA	12,411	30,821	5,371	O, CO
	SANTA CRUZ	1,816	4,511	786	O
	SOLANO	2,093	5,196	906	O
	STANISLAUS*	**2,454**	6,093	**1,063**	**TSP**, CO,O
	SUTTER	490	1,218	212	O
	TULARE*	**2,032**	**3,884**	**961**	**TSP** O
	VENTURA*	**4,880**	**12,117**	**2,112**	**TSP** O
	YOLO	1,090	2,710	472	O
	YUBA	458	1,153	206	O
COLORADO					
	BOULDER	1,580	4,262	630	TSP,C,O
	DENVER*	**3,906**	**10,532**	**1,558**	**TSP** C,N,O
	DOUGLAS	436	816	317	O, C
	JEFFERSON	3,170	8,726	31,767	TSF, C,O
	MESA	612	1,652	6,139	
	PUEBLO*	**855**	**3,432**	**8,690**	**TSP**
CONNECTICUT					
	FAIRFIELD	8,374	19,864	93,313	O
	HARTFORD	8,323	19,757	92,620	O
	LITCHFIELD	1,624	3,852	18,096	O
	MIDDLESEX	1,331	3,158	14,836	O
	NEW HAVEN	7,812	18,534	87,061	O, C
	NEW LONDON	2,577	6,117	28,725	O
	TOLLAND	1,171	2,775	13,041	O
	WINDHAM	953	2,262	10,629	O

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	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
DELAWARE					
	NEW CASTLE	398,115	15,264	6,337	8,390
D OF COLUMBIA					
	WASHINGTON	657,545	22,718	9,484	14,390
FLORIDA					
	BROWARD	1,018,200	31,090	13,144	21,890
	DADE	1,625,781	48,742	20,577	34,950
	DUVAL	571,003	18,351	7,747	12,270
	HILLSBOROUGH	646,960	20,057	8,467	13,910
	ORANGE	471,016	14,248	6,015	10,120
	PALM BEACH	576,863	17,027	7,188	12,390
	PINELLAS	728,531	22,804	9,627	15,660
GEORGIA					
	CLAYTON	150,357	6,172	2,581	3,050
	COBB	297,718	11,176	4,674	6,030
	COWETA	39,268	1,584	662	800
	DE KALB	483,024	19,419	8,142	9,800
	DOUGLAS	54,573	2,211	925	1,110
	FAYETTE	29,043	1,016	425	590
	FULTON	589,904	22,684	9,488	11,960
	GWINNETT	166,903	6,122	2,561	3,380
	HENRY	36,309	1,294	541	730
	MUSCOGEE	170,108	6,886	2,880	3,450
	PAULDING	26,110	1,033	432	530
	ROCKDALE	36,747	1,447	586	740
IDAHO					
	BANNOCK CITY	65,412	2,721	2,498	21,196
	POWER CITY	6,844	285	261	2,217
	CARIBOU CITY	8,695	450	332	2,817

AREA	EMPHYS	C/BRONCH	65+	CODE
DELAWARE				
NEW CASTLE	3,676	9,373	37,940	0
D OF COLUMBIA				
WASHINGTON	6,230	15,891	69,902	0, C
FLORIDA				
BROWARD*	11,498	24,115	161,066	0
DADE*	17,971	37,447	252,135	0
DUVAL	6,776	14,239	94,925	0
HILLSBOROUGH	7,406	15,564	103,750	0
ORANGE	5,257	10,994	73,702	0
PALM BEACH*	6,288	13,212	88,077	0
PINELLAS	8,642	18,758	117,959	0
GEORGIA				
CLAYTON*	1,307	3,406	13,919	
COBB*	2,367	6,169	25,200	0
COWETA*	333	872	3,572	0
DE KALB*	4,113	10,722	43,788	0
DOUGLAS*	468	1,220	4,986	0
FAYETTE*	214	561	2,290	0
FULTON*	4,805	12,525	51,168	0
GWINNETT*	1,297	3,380	13,807	0
HENRY*	273	714	2,918	0
MUSCOGEE	1,460	3,802	15,529	0
PAULDING*	219	570	2,329	0
ROCKDALE*	307	799	3,263	0
IDAHO				
BANNOCK*	610	2,232	6,531	TSP
POWER*	63	259	684	TSP
CARIBOU*	76	229	861	TSP

PAR DATA MATRIX [4]

AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
ILLINOIS				
ADAMS	71,622	2,632	1,094	1,480
BOONE	28,630	1,040	432	590
CHAMPAIGN	168,392	6,558	2,722	3,490
COOK	**5,253,655**	**201,921**	**83,810**	**108,780**
DE KALB	74,624	2,868	1,190	1,540
DU PAGE	658,835	22,134	9,835	13,640
GRUNDY	30,582	1,122	466	640
KANE	278,405	10,750	4,462	5,760
KANKAKEE	102,926	3,682	1,528	2,130
KENDALL	37,202	1,329	552	770
LAKE	440,372	16,684	6,925	9,120
LA SALLE	112,033	4,155	1,725	2,320
MC HENRY	147,897	548	1,610	3,060
MC LEAN	119,149	4,764	1,978	2,460
MACON *	**131,375**	**4,932**	**2,047**	**2,720**
MADISON *	**247,691**	**4,228**	**3,213**	**5,120**
MONROE	20,117	726	301	420
PEORIA	200,466	7,776	3,228	4,140
ROCK ISLAND	165,968	6,263	2,600	3,430
SANGAMON	176,089	6,870	2,852	3,650
ST CLAIR	**267,531**	**10,738**	**4,458**	**5,550**
TAZEWELL	132,078	5,061	2,101	2,730
WILL	324,460	12,585	5,224	6,720
WILLIAMSON	56,538	2,092	868	1,170
WINNEBAGO	250,884	9,238	3,835	4,630
INDIANA				
ALLEN	294,335	11,497	4,794	6,030
CLARK *	**88,838**	**3,528**	**1,471**	**1,820**
ELKHART	137,330	5,397	2,250	2,820
FLOYD	61,169	2,297	958	1,250
LAKE *	**552,965**	**21,369**	**8,911**	**11,320**
MARION *	**765,233**	**30,101**	**12,552**	**15,660**
PORTER	119,816	4,325	1,803	2,450
ST. JOSEPH	241,617	9,350	3,899	4,940
VANDERBURGH	167,515	6,295	2,625	3,420
VIGO	112,385	4,353	1,815	2,300
IOWA				
DES MOINES	**103,566**	**4,143**	**1,147**	**1,933**

	AREA	EMPHYS	C/BRONCH	65+	CODE
ILLINOIS					
	ADAMS	671	1,622	7,514	0
	BOONE	264	641	2,965	0
	CHAMPAIGN	1,671	3,983	18,696	0
	COOK*	**50,766**	**124,374**	575,662	**TSP**, 0
	DE KALB	730	1,766	8,175	0
	DU PAGE	6,039	14,595	67,551	0
	GRUNDY	285	691	3,199	0
	KANE	2,740	6,622	30,648	0
	KANKAKEE	673	2,372	7,499	0
	KENDALL	295	767	2,690	0
	LAKE	4,251	10,277	47,564	0
	LA SALLE	1,058	2,560	11,846	0
	MC HENRY	1,395	3,374	15,615	0
	MC LEAN	1,214	2,934	13,582	0
	MACON*	**1,257**	3,038	**14,061**	**TSP**, 0
	MADISON*	**2,403**	5,807	**26,877**	**TSP**, 0
	MONROE	184	447	2,070	0
	PEORIA	1,981	4,790	22,170	0
	ROCK ISLAND	1,597	3,858	17,857	0
	ST. CLAIR*	**2,736**	**6,614**	**30,614**	**TSP**, 0
	SANGAMON	1,039	4,231	19,586	0
	TAZEWELL	1,290	3,118	14,429	0
	WILL	3,207	7,752	35,877	0
	WILLIAMSON	532	1,288	5,964	0
	WINNEBAGO	2,365	5,692	26,378	0
INDIANA					
	ALLEN	2,690	3,657	29,378	0
	CLARK*	**805**	**2,076**	**8,951**	**TSP**
	ELKHART	1,263	3,176	13,692	0
	FLOYD	504	1,351	5,826	0
	LAKE*	**5,001**	**12,576**	**54,214**	**TSP 0**
	MARION*	**7,044**	**17,715**	**76,369**	**CO S,0**
	PORTER	1,012	2,544	10,969	0
	ST. JOSEPH	2,089	5,353	23,721	0
	VANDERBURGH	1,474	3,632	15,969	0
	VIGO	1,020	2,561	11,044	0
IOWA					
	DES MOINES, POLK*	**1,120**	**3,296**	**13,464**	**TSP**

	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
KANSAS					
	DOUGLAS	67,640	2,474	1,030	1,400
	JOHNSON	270,269	9,574	3,985	5,600
	KANSAS CITY	**161,387**	**6,416**	**1,292**	**3,346**
	WHICHITA	279,272	10,891	2,945	5,391
	WYANDOTTE	172,335	6,288	2,618	3,580
KENTUCKY					
	BELL	34,330	1,349	564	700
	BOONE	45,842	1,672	699	930
	BOYD	55,513	2,073	861	1,130
	CORBIN, WHITLEY	**6,739**	**245**	**59**	**137**
	FAYETTE	204,165	7,635	3,193	4,160
	HAZARD, PERRY	**5,371**	**196**	**47**	**110**
	HENDERSON	**40,849**	**1,476**	**617**	**840**
	JEFFERSON	685,004	26,450	11,062	13,960
	KENTON	137,058	5,093	2,130	2,800
	LOUISA, LAWRENCE	**1,832**	**67**	**16**	**37**
	MC CRACKEN	**61,310**	**2,430**	**1,016**	**1,240**
	MUHLENBERG	32,238	1,274	533	670
	NEWPORT, CAMPBELL	**21,587**	**786**	**190**	**430**
	RICHMOND, MADISON	**21,705**	**790**	**191**	**443**
LOUISIANA					
	ASCENSION PAR	50,068	1,552	802	990
	BEAUREGARD PAR	29,692	1,229	513	590
	BOSSIER	80,721	3,108	1,296	1,610
	CADDO	252,358	10,390	4,334	5,020
	CALCASIEU	167,223	6,755	2,818	3,330
	EAST BATON ROUGE	**366,191**	**14,424**	**6,017**	**7,300**
	GRANT PAR	16,703	654	273	330
	IBERVILLE	32,159	1,275	532	630
	JEFFERSON	**454,592**	**19,105**	**7,970**	**9,050**
	LAFAYETTE	150,017	5,889	2,457	2,990
	LAFOURCHE	82,483	3,298	1,376	1,650
	ORLEANS	**557,515**	**23,076**	**9,627**	**11,110**
	POINTE COUPEE	24,045	932	389	490
	ST. BERNARD	**64,097**	**2,712**	**1,131**	**1,280**
	ST. CHARLES	37,259	1,515	632	740
	ST. JAMES	21,495	824	344	430
	ST JOHN THE BAPT	31,924	1,168	487	630
	ST. MARY	64,253	2,615	1,090	1,280
	WEST BATON ROUGE	**19,086**	**765**	**310**	**390**

	AREA	EMPHYS	C/BRONCH	65+	CODE
KANSAS					
	DOUGLAS	714	1,673	8,924	0
	JOHNSON	2,767	6,474	34,537	0
	KANSAS CITY	**1,718**	**5,503**	**20,850**	**TSP**
	WICHITA*	**2,285**	**1,539**	**36,150**	**CO**
	WYANDOTTE*	**1,815**	**4,252**	**22,684**	**TSP 0**
KENTUCKY					
	BELL*	**331**	**810**	**3,804**	**TSP 0**
	BOONE	411	1,003	4,715	0
	BOYD*	**510**	**1,244**	**5,847**	**TSP S,0**
	CORBIN, WHITLEY*	**136**	**231**	**755**	**TSP**
	FAYETTE	1,880	4,539	21,535	0
	HAZARD, PERRY*	**52**	**183**	**602**	**TSP**
	HENDERSON*	**364**	**886**	**4,164**	**TSP**
	JEFFERSON*	**5,944**	**15,582**	**74,604**	**TSPS C 0**
	KENTON	1,254	3,058	14,364	0
	LOUISA, LAWRENCE*	**17**	**62**	**205**	**TSP**
	MC CRACKEN*	**597**	**1,459**	**6,855**	**TSP**
	MUHLENBERG	314	765	3,594	TSP,S
	NEWPORT, CAMPBELL*	**212**	**733**	**2,418**	**TSP**
	RICHMOND, MADISON*	**212**	**744**	**2,431**	**TSP**
LOUISIANA					
	ASCENSION PAR	405	1,037	4,425	0
	BEAUREGARD PAR	258	663	2,830	0
	BOSSIER	655	1,179	7,158	0
	CADDO	2,986	5,601	23,926	0
	CALCASIEU	1,423	3,693	15,556	0
	EAST BATON ROUGE*	**3,039**	**7,775**	**33,217**	**0**
	GRANT PAR	138	352	1,507	0
	IBERVILLE	269	686	2,935	0
	JEFFERSON*	**4,024**	**10,296**	**43,998**	**0**
	LAFAYETTE	1,241	3,175	13,563	0
	LAFOURCHE	695	1,779	7,596	0
	ORLEANS*	**4,863**	**12,451**	**53,143**	**0**
	POINTE COUPEE	196	503	2,148	0
	ST. BERNARD*	**571**	**1,462**	**6,245**	**0**
	ST. CHARLES	317	815	3,488	0
	ST. JAMES	174	2,255	1,900	0
	ST JOHN THE BAPT	221	630	2,690	0
	ST. MARY	550	1,408	6,017	0
	WEST BATON ROUGE*	**161**	**412**	**1,763**	**0**

PAR DATA MATRIX [6]

	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
MAINE					
	ANDROSCOGGIN	99,657	3,608	1,531	2,050
	CUMBERLAND	215,789	7,785	3,304	4,460
	KENNEBEC	109,889	3,950	1,676	2,270
	KNOX	32,941	1,268	538	690
	LINCOLN	25,691	967	410	530
	SAGADAHOC	28,795	1,021	433	600
	WALDO	28,414	1,080	458	580
	YORK	139,666	4,899	2,084	2,890
MARYLAND					
	ANNE ARUNDEL	370,775	13,455	5,857	7,820
	BALTIMORE	655,615	23,330	9,994	13,830
	CARROLL	96,356	3,379	1,471	2,030
	HARFORD	145,930	5,493	2,390	3,080
	HOWARD	118,572	4,530	1,972	2,490
	MONTGOMERY	579,053	20,868	9,083	12,210
	PRINCE GEORGES	665,071	23,935	10,419	14,020
	BALTIMORE CITY	786,775	27,160	11,823	16,580
MONTANA					
	MISSOULA	33,388	1,215	273	678
NEBRASKA					
	LINCOLN	171,932	7,266	1,316	4,088
	OMAHA	314,255	12,746	2,401	7,472
NEVADA					
	LAS VEGAS, CLARK	34,674	2,517	308	709
	RENO	99,701	3,764	885	2,744
	McGILL	1,419	54	13	29
NEW HAMPSHIRE					
	METRO BERLIN	13,804	517	120	279
	NASHAU	67,805	2,539	591	1,346

	AREA	EMPHYS	C/BRONCH	65+	CODE
MAINE					
	ANDROSCOGGIN	991	2,321	11,757	0
	CUMBERLAND	2,139	5,008	25,370	0
	KENNEBEC	1,085	2,540	12,872	0
	KNOX	348	816	4,131	0
	LINCOLN	261	611	3,096	0
	SAGADAHOC	280	657	3,327	0
	WALDO	296	695	3,519	0
	YORK	135	316	1,602	0
MARYLAND					
	ANNE ARUNDEL	3,420	8,888	33,620	0
	BALTIMORE	5,835	15,164	57,367	0
	CARROLL	859	2,232	8,444	0
	HARTFORD	1,395	3,628	13,725	0
	HOWARD	1,151	2,991	11,319	0
	MONTGOMERY	5,303	13,782	52,140	0
	PRINCE GEORGES	6,084	15,808	59,804	0
	BALTIMORE CITY	6,903	17,939	67,862	0
MICHIGAN					
	PART OF WAYNE CO*	21,224	51,377	230,304	TSP
MINNESOTA					
	HENNEPIN*	9,221	32,865	110,145	TSP
	STEARNS*	1,060	3,776	12,655	CO
	ST. LOUIS*	2,176	7,757	26,001	CO, TSP, S, 0
	DAKOTA*	1,436	6,782	22,731	S
	RAMSEY*	4,504	16,051	53,795	CO
MISSOURI					
	ST. LOUIS*	4,895	15,964	59,711	TSP
MONTANA					
	MISSOULA*	335	1,140	3,673	CO
NEBRASKA					
	LINCOLN, LANCASTER*	1,856	6,380	22,351	CO
	OMAHO, DOUGLAS*	3,394	11,662	40,853	CO
NEVADA					
	LAS VEGAS, CLARK*	334	1,174	3,087	TSP, O
	RENO, WASHOE*	942	3,373	8,873	TSP
	McGILL, WHITE PINE*	13	51	126	S
NEW HAMPSHIRE					
	METROPOLITAN BERLIN*	137	469	1,560	TSP
	NASHUA, HILLSBOROUGH*	671	1,986	7,662	CO

PAR DATA MATRIX [7]

	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
NEW JERSEY					
	ATLANTIC	194,119	6,800	2,965	4,130
	BERGEN	845,385	29,955	13,060	18,000
	BURLINGTON	362,542	13,187	5,749	7,720
	CAMDEN	471,650	17,752	7,370	10,040
	CAPE MAY	82,266	2,841	1,239	1,750
	CUMBERLAND	132,866	4,667	2,035	2,820
	ESSEX	851,116	28,500	12,426	18,120
	GLOUCHESTER	199,917	7,109	3,100	4,250
	HUDSON	556,972	18,975	8,273	11,860
	HUNTERDON	87,361	3,042	1,326	1,860
	MERCER	307,863	11,114	4,856	6,560
	MIDDLESEX	595,893	20,521	8,947	12,680
	MONMOUTH	503,173	17,541	7,636	10,710
	MORRIS	407,630	13,891	6,056	8,680
	OCEAN	346,038	12,537	5,465	7,360
	PASSAIC	447,585	15,918	6,940	9,530
	SALEM	64,676	2,194	954	1,380
	SOMERSET	203,129	7,114	3,102	4,330
	SUSSEX	116,119	3,977	1,734	2,460
	UNION	504,094	17,334	7,558	10,730
	WARREN	84,429	2,952	1,287	1,800
NEW MEXICO					
	BERNALILLO	419,700	17,148	7,041	8,330
	GRANT*	26,204	1,973	320	470

AREA	EMPHYS	C/BRONCH	65+	CODE
NEW JERSEY				
ATLANTIC	2,028	5,100	22,054	0
BERGEN	8,934	20,938	97,156	0
BURLINGTON	3,925	9,217	42,771	0
CAMDEN	4,928	11,549	53,594	0
CAPE MAY	1,703	1,986	9,214	0
CUMBERLAND	1,392	3,262	15,136	0
ESSEX	8,499	19,920	92,436	0
GLOUCHESTER	2,120	4,969	23,059	0
HUDSON	3,189	13,263	61,544	0
HUNTERDON	908	2,126	9,866	0
MERCER	3,315	7,569	36,047	0
MIDDLESEX	6,120	14,344	66,559	0
MONMOUTH	5,224	12,243	56,805	0
MORRIS	4,143	9,710	45,054	0
OCEAN	3,739	8,762	40,657	0
PASSAIC	4,748	11,126	51,629	0
SALEM	654	1,533	7,116	0
SOMERSET	2,122	4,972	23,073	0
SUSSEX	1,184	2,779	12,898	0
UNION	5,170	12,116	56,224	0
WARREN	880	2,064	9,573	0
NEW MEXICO				
BERNALILLO	3,402	8,876	35,382	TSP
GRANT	223	914	2,338	TSP,S

PAR DATA MATRIX [8]

	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
NEW YORK					
	ALBANY	285,909	3,735	4,209	6,070
	BRONX	1,168,972	41,407	17,904	24,800
	CAYUGE	79,894	2,646	1,144	1,700
	COLUMBIA	59,487	1,656	813	1,260
	DUTCHESS	245,055	8,009	3,463	5,190
	ERIE	1,015,472	36,091	15,612	21,540
	GENESEE	59,400	2,087	902	1,260
	GREENE	40,861	1,372	593	880
	KINGS	2,230,936	76,070	32,893	47,330
	LACKAWANNA	22,701	788	185	425
	LIVINGSTON	57,006	1,972	854	1,210
	MONROE	702,238	23,938	10,351	14,900
	NASSAU	1,321,582	47,142	20,384	28,040
	NEW YORK	1,428,285	45,212	19,550	30,300
	NIAGARA	227,354	8,101	3,502	4,820
	ONONDAGO	463,920	16,116	6,969	9,840
	ONTARIO	88,909	3,020	1,306	1,880
	ORANGE	259,603	8,714	3,768	5,510
	ORLEANS	38,496	1,330	1,275	820
	PUTNAM	77,193	2,621	1,133	1,640
	QUEENS	1,891,325	66,174	28,615	40,130
	RENSSELEER	151,966	5,127	2,217	3,220
	RICHMOND	352,121	11,759	5,085	7,480
	ROCKLAND	259,530	909	2,831	5,510
	SCHENECTADY	149,946	5,225	2,259	3,190
	SENECA	33,733	1,121	485	710
	SUFFOLK	1,284,231	46,123	19,943	2,725
	ULSTER	158,158	5,418	2,343	3,360
	WAYNE	84,581	2,905	1,272	1,790
	WESTCHESTER	866,599	30,464	12,863	18,380
	WYOMING	39,895	1,331	576	840
	YATES	21,459	737	319	460

AREA	EMPHYS	C/BRONCH	65+	CODE
NEW YORK				
ALBANY	2,767	6,607	34,038	0
BRONX	12,596	29,360	144,777	CO
CAYUGE	804	1,860	9,251	0
COLUMBIA	603	1,407	6,936	0
DUTCHESS	2,437	5,678	28,003	0
ERIE*	**10,978**	**22,592**	**126,193**	**TSP**
GENESEE	634	1,479	7,296	0
GREENE	417	973	4,797	0
KINGS	23,140	53,940	265,980	CO, 0
LACKAWANA	**242**	**774**	**2,680**	**TSP**
LIVINGSTON	599	1,398	6,894	0
MONROE	7,281	16,974	83,700	0
NASSAU	14,308	33,427	164,829	0
NEW YORK	13,753	32,059	158,085	CO, 0
NIAGARA	2,464	5,745	28,323	0
ONONDAGO	4,902	11,428	56,350	0
ONTARIO	918	2,141	10,559	0
ORANGE	2,651	6,178	30,468	0
ORLEANS	404	943	4,647	0
PUTNAM	797	1,858	9,165	0
QUEENS	20,130	46,923	231,376	CO, 0
RENSSELEER	1,559	3,636	17,926	0
RICHMOND	3,577	6,584	41,113	0
ROCKLAND	2,767	6,449	31,802	0
SCHENECTADY	1,589	3,706	18,270	0
SENECA	341	775	3,920	0
SUFFOLK	14,031	17,465	161,269	0
ULSTER	1,648	3,842	18,944	0
WAYNE	857	1,999	9,854	0
WESTCHESTER	8,951	20,865	102,880	0
WYOMING	405	944	4,655	0
YATES	224	523	2,577	0

PAR DATA MATRIX [9]

AREA	POP/BASE	POP<2	ASTHMA/A	ASTHMA/A
NORTH CAROLINA				
MECKLENBURG	404,270	14,604	6,190	8,380
OHIO				
ALLEN	112,241	4,070	1,703	2,320
ASHLAND	46,178	1,724	721	950
ASHTABULA	104,215	3,875	1,621	2,160
BELMONT	82,569	3,208	1,342	1,710
BROWN	31,920	1,230	515	660
BUTLER	258,787	10,034	4,198	5,370
CARROLL	25,598	1,043	436	530
CHAMPAIGN	33,649	1,290	540	700
CLARK	150,236	5,702	2,386	3,110
CLERMONT	128,483	4,688	1,961	2,660
CLINTON	34,603	1,293	541	720
COLUMBIANA	**113,572**	**4,415**	**1,847**	**2,360**
CUYAHOGA	**1,498,400**	**58,050**	**24,289**	**31,050**
DARKE	55,096	2,132	603	1,045
DELAWARE	53,840	2,110	883	1,110
ERIE	79,655	2,985	1,249	1,660
FAIRFIELD	93,678	3,544	1,483	1,940
FAYETTE	27,467	1,021	427	570
FRANKLIN	869,132	34,195	14,307	18,010
FULTON	37,751	1,461	413	715
GEAUGA	74,474	2,812	1,177	1,550
GREENE	129,769	5,055	2,115	2,680
HAMILTON	873,224	33,528	14,028	18,100
HANCOCK	64,581	2,428	1,016	1,340
HARRISON	18,152	684	286	380
HENRY	28,383	1,107	463	590
HIGHLAND	33,477	1,278	535	700
HOCKING	24,304	887	1,071	500
HOLMES	29,416	1,016	425	610
HURON	54,608	2,063	867	1,130
JACKSON	30,592	1,192	498	630
JEFFERSON	**91,564**	**3,577**	**1,497**	**1,900**
KNOX	46,304	1,710	716	1,020
LAKE	212,801	8,337	3,488	4,410
LAWRENCE	63,849	2,477	1,036	1,320
LICKING	120,981	4,546	1,902	2,500
LOGAN	39,155	1,468	614	810
LORAIN	274,909	10,301	4,310	5,700
LUCAS	471,741	17,916	7,496	9,770
MADISON	33,004	1,292	540	680
MAHONING	289,487	11,517	4,819	6,000
MARION	67,974	2,603	1,088	1,400
MEDINA	113,150	4,469	1,870	2,340
MEIGS	23,641	1,780	259	448

AREA	EMPHYS	C/BRONCH	65+	CODE
NORTH CAROLINA				
MECKLENBURG	3,552	8,932	38,507	CO, O
OHIO				
ALLEN	1,004	2,481	10,600	O
ASHLAND	422	1,043	4,481	O
ASHTABULA	950	2,345	10,069	O
BELMONT	787	1,942	8,338	O
BROWN	301	745	3,197	O
BUTLER	2,460	6,074	26,075	O
CARROLL	256	631	2,710	O
CHAMPAIGN	317	782	3,357	O
CLARK	1,399	3,451	14,817	O
CLERMONT	1,136	2,837	12,183	O
CLINTON	317	782	3,359	TSP,O
COLUMBIANA*	**1,082**	**2,672**	**11,472**	**TSP**
CUYAHOGA*	**14,231**	**35,138**	**150,856**	**TSP**, CO, O
DARKE	547	1,928	5,965	O
DELAWARE	517	1,278	5,483	O
ERIE	732	1,807	7,756	O
FAIRFIELD	883	2,326	9,211	O
FAYETTE	251	619	2,654	O
FRANKLIN	8,386	20,698	88,865	CO,O
FULTON	374	1,321	4,087	O
GEAUGA	690	1,702	7,308	O
GREENE	1,148	3,060	13,138	O
HAMILTON	8,221	20,294	87,130	CO, O
HANCOCK	595	1,470	6,311	O
HARRISON	168	414	1,778	O
HENRY	271	669	2,876	O
HIGHLAND	313	773	3,322	O
HOCKING	218	536	2,305	O
HOLMES	249	615	2,639	O
HURON	583	1,245	5,386	O
JACKSON	292	722	3,097	O
JEFFERSON*	**713**	**2,163**	**9,297**	**TSP**, CO,O
KNOX	420	1,035	4,445	O
LAKE	2,043	5,047	21,666	O
LAWRENCE	1,005	1,973	16,437	O
LICKING	1,114	2,752	11,815	O
LOGAN	360	889	3,816	O
LORAIN	2,525	6,235	26,771	O
LUCAS	4,392	10,844	46,559	O
MADISON	317	782	3,358	O
MAHONING*	**2,824**	**6,972**	**29,930**	**TSP**, CO,O
MARION	638	1,575	6,760	O
MEDINA	1,096	2,705	11,614	O
MEIGS	1,240	827	2,560	TSP

	AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
OHIO					
	MIAMI	90,381	3,450	1,443	1,870
	MONTGOMERY	571,697	22,038	9,220	11,840
	MORROW	26,480	976	408	540
	MUSKINGUM	83,340	3,186	1,333	1,730
	OTTAWA	40,076	1,497	626	830
	PERRY	31,032	1,135	475	650
	PICKAWAY	43,662	1,754	734	900
	PORTAGE*	**135,856**	**5,202**	**2,176**	**2,810**
	PREBLE	38,223	1,446	605	800
	RICHLAND*	**131,205**	**5,025**	**2,103**	**2,720**
	ROSS	65,004	2,389	967	1,350
	SANDUSKY*	**63,267**	**2,421**	**1,013**	**1,310**
	SENECA	61,901	2,299	962	1,280
	SHELBY	43,089	1,979	722	900
	STARK	378,823	14,597	6,107	7,850
	SUMMIT*	**524,472**	**20,106**	**8,412**	**10,870**
	TRUMBULL	241,863	9,392	4,518	5,020
	TUSCARAWAS	84,614	3,157	1,320	1,750
	UNION	29,536	1,137	476	610
	WARREN	99,276	3,567	1,492	2,050
	WASHINGTON	64,266	2,361	988	1,340
	WAYNE	97,408	4,158	1,740	2,020
	WOOD	107,372	3,738	1,564	2,230
OKLAHOMA					
	TULSA*	**360,919**	**27,177**	**3,896**	**6,820**
OREGON					
	JACKSON	132,456	9,974	1,389	2,523
PENNSYLVANIA					
	ADAMS	68,292	2,317	979	1,460
	ALLEGHENY	**1,450,085**	**51,792**	**21,926**	**30,980**
	ARMSTRONG	77,768	2,712	1,148	1,660
	BEAVER	204,441	7,446	3,153	4,360
	BEDFORD	46,784	1,548	655	1,000
	BERKS	312,509	10,935	4,629	6,670
	BLAIR	136,621	4,747	2,010	2,920
	BRADFORD	62,919	2,205	934	1,350
	BUCKS	479,211	17,473	7,397	10,240
	BUTLER	147,912	5,217	2,209	3,160
	CAMBRIA	183,263	6,742	2,854	3,910
	CAMERON	6,674	238	101	140
	CARBON	53,285	1,901	805	1,130
	CENTRE	112,760	4,035	1,708	2,410
	CHESTER	316,660	10,994	4,655	6,760
	CLARION	43,362	1,506	638	930
	CLEARFIELD	83,578	2,895	1,226	1,790
	CLINTON	38,971	1,344	569	840

	AREA	EMPHYS	C/BRONCH	65+	CODE
OHIO					
	MIAMI	846	2,310	8,965	0
	MONTGOMERY	5,392	7,292	57,272	CO, 0
	MORROW	239	591	2,537	0
	MUSKINGUM	787	1,989	8,288	S
	OTTAWA	370	906	3,891	0
	PERRY	340	782	2,951	0
	PICKAWAY	430	1,062	4,560	0
	PORTAGE*	**1,275**	**3,149**	**13,517**	**0**
	PREBLE	355	875	3,759	0
	RICHLAND*	**1,232**	**3,042**	**13,063**	**TSP** 0
	ROSS	723	1,655	6,209	0
	SANDUSKY*	**593**	**1,465**	**6,292**	**TSP** 0
	SENECA	564	1,392	5,976	0
	SHELBY	393	971	4,169	0
	STARK	3,579	8,835	37,934	0
	SUMMIT*	**4,930**	**12,171**	**52,252**	**0**
	TRUMBULL	2,321	6,038	24,407	0
	TUSCARAWAS	775	1,911	8,204	0
	UNION	279	688	2,954	0
	WARREN	875	2,010	9,269	0
	WASHINGTON	579	1,429	6,137	S
	WAYNE	1,019	2,517	10,806	0
	WOOD	917	2,262	9,714	0
OKLAHOMA					
	TULSA	**3,730**	**12,681**	**44,861**	**0**
OREGON					
	JACKSON	1,305	4,606	15,243	TSP
PENNSYLVANIA					
	ADAMS	711	1,602	8,363	0
	ALLEGHENY*	**15,948**	**35,951**	**187,653**	**TSP,S** 0
	ARMSTRONG	814	1,857	9,287	0
	BEAVER	2,294	5,169	26,981	0
	BEDFORD	476	1,074	5,609	0
	BERKS	3,368	7,590	39,618	0
	BLAIR	11,461	3,295	17,200	0
	BRADFORD	679	1,532	7,991	0
	BUCKS	5,380	12,129	63,308	0
	BUTLER	1,606	3,621	18,903	0
	CAMBRIA	2,076	4,681	24,428	0
	CAMERON	73	99	862	0
	CARBON	584	1,318	6,886	0
	CENTRE	1,242	2,801	14,618	0
	CHESTER	3,385	7,632	39,836	0
	CLARION	464	1,046	5,458	0
	CLEARFIELD	892	2,010	10,490	0
	CLINTON	412	933	4,868	0

AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
PENNSYLVANIA				
COLUMBIA	61,967	2,188	926	1,330
CRAWFORD	88,869	3,098	1,312	1,890
CUMBERLAND	178,541	6,303	2,668	3,820
DAUPHIN	232,317	7,975	3,376	4,960
DELAWARE	555,007	20,481	9,371	11,860
ELK	38,338	1,295	548	810
ERIE	279,780	9,903	4,193	5,970
FAYETTE	159,417	5,577	2,361	3,410
FOREST	5,072	196	83	110
FRANKLIN	113,629	3,910	1,656	2,430
FULTON	12,842	432	183	210
GREENE	40,476	1,426	604	870
HUNTINGDON	42,253	1,451	614	900
INDIANA	92,281	3,216	1,362	1,970
JEFFERSON	48,303	1,730	732	1,030
JUNIATA	19,188	668	283	410
LACKAWANNA*	**227,908**	**8,210**	**3,476**	**4,860**
LANCASTER	362,346	11,744	5,272	7,740
LAWRENCE	107,150	3,760	1,592	2,290
LEBANON	108,582	3,888	1,646	2,310
LEHIGH	272,349	9,616	4,061	5,820
LUZERNE*	**343,079**	**11,588**	**4,776**	**7,330**
LYCOMING	118,416	4,130	1,749	2,530
MC KEAN	50,635	1,817	790	1,080
MERCER	**128,299**	**4,530**	**1,918**	**2,740**
MIFFLIN	46,908	1,554	658	1,010
MONROE	69,409	2,222	941	2,490
MONTGOMERY	643,621	22,509	9,530	13,760
MONTOUR	16,675	596	252	350
NORTHAMPTON	225,418	8,105	3,431	4,820
NORTHUMBERLAND	100,381	3,528	1,494	2,140
PERRY	35,718	1,246	527	770
PHILADELPHIA	1,688,210	61,254	25,932	36,060
PIKE	18,271	571	242	390
POTTER	17,726	608	258	380
SCHUYLKILL	160,630	5,623	2,380	3,430
SCRANTON	**88,117**	**2,978**	**703**	**1,842**
SHARON	**19,057**	**644**	**152**	**398**
SNYDER	33,584	1,149	486	720
SOMERSET	81,243	2,872	1,216	1,740
SULLIVAN	6,349	218	92	140
SUSQUEHANNA	37,876	1,385	586	810
TIOGA	40,973	1,512	640	870
UNION	32,870	1,139	482	700
VENANGO	64,444	2,266	959	1,370
WARREN	47,449	1,660	703	1,020
WASHINGTON	217,074	7,675	3,249	4,640
WAYNE	35,237	1,312	555	760
WESTMORELAND	392,294	13,731	5,813	8,380
WILKES-BARRE	**51,557**	**1,743**	**412**	**1,078**
WYOMING	26,433	910	385	560
YORK	312,963	10,564	4,473	6,690

AREA	EMPHYS	C/BRONCH	65+	CODE
PENNSYLVANIA				
COLUMBIA	673	1,519	7,927	0
CRAWFORD	954	2,150	11,225	0
CUMBERLAND	1,941	4,376	22,838	0
DAUPHIN	2,456	5,536	28,894	0
DELAWARE	6,306	14,216	74,207	0
ELK	399	898	4,690	0
ERIE	3,050	6,874	35,881	0
FAYETTE	1,717	3,871	20,204	0
FOREST	61	137	711	0
FRANKLIN	1,204	2,714	14,169	0
FULTON	133	299	1,565	0
GREENE	436	764	5,131	0
HUNTINGDON	447	941	5,258	0
INDIANA	991	2,232	11,654	0
JEFFERSON	532	1,569	6,266	0
JUNIATA	206	464	2,420	0
LACKAWANNA*	**2,522**	**5,686**	**29,678**	**0**
LANCASTER	3,979	8,925	47,386	0
LAWRENCE	1,158	2,610	13,624	0
LEBANON	1,198	2,699	14,085	0
LEHIGH	2,950	6,653	34,722	0
LUZERNE*	**3,729**	**8,403**	**43,866**	**0**
LYCOMING	1,271	2,866	14,964	0
MC KEAN	559	1,260	6,573	0
MERCER*	**1,395**	**3,145**	**16,412**	**TSP**
MIFFLIN	478	1,079	5,630	0
MONROE	684	1,531	8,051	0
MONTGOMERY	6,931	12,145	81,556	0
MONTOUR	184	413	2,159	0
NORTHAMPTON	1,086	2,449	12,783	0
NORTHUMBERLAND	1,086	2,449	12,783	0
PERRY	384	865	4,515	0
PHILADELPHIA	18,862	55,589	221,934	0
PIKE	175	397	2,070	0
POTTER	187	422	2,204	0
SCHUYLKILL	1,732	3,904	20,373	0
SCRANTON	**980**	**3,013**	**11,103**	**0**
SHARON	**212**	**652**	**2,401**	**TSP**
SNYDER	354	797	4,163	0
SOMERSET	884	1,994	10,406	0
SULLIVAN	67	151	791	0
SUSQUEHANNA	426	961	5,017	0
TIOGA	465	1,050	5,477	0
UNION	353	792	4,162	0
VENANGO	698	1,573	8,211	0
WARREN	515	1,157	6,062	0
WASHINGTON	2,364	5,328	27,809	0
WAYNE	404	910	4,753	0
WESTMORELAND	4,228	9,531	49,749	0
WILES-BARRE	**572**	**1,764**	**6,496**	**0**
WYOMING	280	631	3,298	0
YORK	3,252	7,333	38,277	0

AREA	POP/BASE	POP<2	ASTHMA/P	ASTHMA/A
RHODE ISLAND				
BRISTOL	46,942	1,607	697	1,000
KENT	154,163	5,404	2,345	3,300
NEWPORT	81,383	2,929	1,271	1,740
PROVIDENCE	571,349	19,497	8,462	12,230
WASHINGTON	93,317	3,232	1,402	1,990
SOUTH CAROLINA				
BERKELEY	94,727	3,240	1,352	1,920
CHARLESTON	276,974	6,230	1,352	5,630
LEXINGTON	140,353	5,788	2,416	2,860
RICHLAND	269,735	10,506	4,386	5,480
YORK	106,720	4,071	1,699	2,170
TENNESSEE				
BRADLEY	67,547	2,360	1,008	1,400
DAVIDSON	477,811	16,605	7,089	9,900
HAMILTON	287,740	10,155	4,335	5,950
KNOX	**319,694**	**11,268**	**4,811**	**6,620**
MAURY	51,095	1,773	757	1,060
ROANE	48,425	1,622	693	1,000
RUTHERFORD	84,058	2,758	1,177	1,740
SHELBY	777,113	27,770	11,655	16,090
SULLIVAN	**143,968**	**5,153**	**2,200**	**2,980**
SUMNER	85,790	2,964	1,265	1,770
WILLIAMSON	58,108	1,994	851	1,210
WILSON	56,064	1,842	786	1,160
TEXAS				
BRAZORIA	169,587	6,090	2,490	3,410
CAMERON CITY*	**19,988**	**831**	**186**	**395**
CORPUS CRISTI	**231,875**	**9,275**	**2,161**	**4,588**
DALLAS*	**1,556,390**	**62,617**	**25,604**	**31,300**
EL PASO	**479,899**	**19,377**	**7,923**	**9,660**
GALVESTON	195,940	8,441	3,451	3,940
GREGG	99,487	3,725	1,765	2,000
HARRIS	**2,409,547**	**94,172**	**38,506**	**48,450**
HOUSTON	**1,574,602**	**62,984**	**14,676**	**38,155**
JEFFERSON	250,938	10,183	4,164	5,050
NEUCES	**268,215**	**10,583**	**4,327**	**5,390**
ORANGE	83,838	3,462	1,416	1,690
TARRANT*	**860,880**	**33,022**	**13,503**	**17,310**
VICTORIA	68,807	2,612	1,068	1,390
UTAH				
DAVIS	146,540	6,867	2,711	2,660
SALT LAKE	619,066	29,935	11,686	11,260
WEBER	144,616	7,324	2,859	2,640

AREA	EMPHYS	C/BRONCH	65+	CODE
RHODE ISLAND				
BRISTOL	466	1,124	5,969	0
KENT	1,646	3,759	20,166	0
NEWPORT	892	2,056	10,931	0
PROVIDENCE	5,936	13,689	72,751	0
WASHINGTON	1,047	2,943	12,061	0
SOUTH CAROLINA				
BERKELEY	680	1,785	7,100	0
CHARLESTON	2,454	6,119	28,139	0
LEXINGTON	1,214	3,188	12,680	0
RICHLAND	2,203	5,787	23,017	0
YORK	853	2,243	8,918	0
TENNESSEE				
BRADLEY	638	1,541	7,132	0
DAVIDSON	4,485	10,841	50,179	0
HAMILTON	2,742	6,631	30,688	0
KNOX*	**3,044**	**7,357**	**34,052**	**CO**
MAURY	479	1,158	5,357	0
ROANE	438	1,059	4,904	0
RUTHERFORD	745	1,800	8,334	0
SHELBY	7,501	18,146	83,918	0
SULLIVAN*	**1,392**	**3,364**	**15,573**	**TSP, 0**
SUMNER	801	1,936	8,958	0
WILLIAMSON	549	1,302	6,024	0
WILSON	499	1,224	5,567	0
TEXAS				
BRAZORIA	1,317	3,345	14,640	0
CAMERON (SAN BENITO)*	**184**	**679**	**1,990**	**TSP**
CORPUS CHRISTI	**3,127**	**7,870**	**23,188**	**TSP**
DALLAS	**13,540**	**34,392**	**150,522**	**0**
EL PASO	**4,190**	**10,531**	**46,580**	**TSP, CO, 0**
GALVESTON	1,825	4,636	20,291	0
GREGG	805	2,046	8,955	0
HARRIS	**12,214**	**51,722**	**226,375**	**TSP, 0**
HOUSTON	**21,233**	**53,439**	**157,460**	**TSP**
JEFFERSON	2,948	5,607	24,477	0
NEUCES	**2,282**	**5,813**	**25,439**	**TSP, 0**
ORANGE	748	1,902	8,323	0
TARRANT	**7,140**	**18,137**	**79,380**	**0**
VICTORIA	565	1,435	6,280	0
UTAH				
DAVIS	1,022	2,800	10,565	0
SALT LAKE	4,456	12,206	46,054	0

	AREA	**POP/BASE**	**POP<2**	**ASTHMA/P**	**ASTHMA/A**
VIRGINIA					
	ARLINGTON	152,599	5,294	2,240	31,900
	CHESTERFIELD	141,372	5,013	2,121	2,960
	FAIRFAX	596,901	21,938	8,690	12,490
	HENRICO	180,735	6,433	2,712	3,780
	LOUDON	57,427	2,196	129	1,200
	PRINCE WILLIAM	144,703	5,299	2,242	3,040
	ROANOKE	72,945	2,569	1,087	1,520
	STAFFORD	40,470	1,411	597	850
	ALEXANDRIA CITY	103,217	3,640	1,540	2,150
	CHESAPEAKE CITY	114,226	4,310	1,823	2,390
	FAIRFAX CITY	19,390	742	314	410
	FALLS CHURCH CITY	9,515	324	137	200
	HAMPTON CITY	122,617	4,669	1,977	2,560
	MANASSAS CITY	15,438	333	141	320
	MANASSAS PARK CITY	6,524	249	105	130
	NEWPORT NEW CITY	144,903	5,301	2,243	3,040
	NORFOLK CITY	266,979	10,051	4,253	5,590
	PORTSMOUTH CITY	104,577	3,882	1,642	2,190
	RICHMOND CITY	219,214	7,733	3,272	4,590
	ROANOKE CITY	100,427	3,374	1,428	2,100
	SALEM CITY	23,958	946	400	510
	VIRGINIA BEACH CITY	262,139	9,401	3,977	5,490
	SUFFOLK CITY	47,621	1,729	732	990
WEST VIRGINIA					
	BROOKE	31,117	1,117	479	650
	HANCOCK	40,418	1,452	623	830
	MARSHALL	41,608	1,463	627	860
	OHIO	61,389	2,084	894	1,270
	PUTNAM	38,181	1,274	546	780
WASHINGTON					
	TACOMA*	**158,501**	6,430	1,671	3,024
	SPOKANE*	**171,300**	6,852	1,806	3,268
	VANCOUVER*	**42,834**	1,713	452	818
	SEATTLE*	**493,846**	19,753	5,207	9,423
WISCONSIN					
	BROWN	175,280	6,642	2,823	3,610
	COLUMBIA	43,222	1,560	663	890
	DANE	323,545	11,647	4,950	6,650
	KENOSHA	123,137	4,615	1,961	2,530
	MILWAUKEE	964,988	35,858	15,240	19,860
	OZAUKEE	66,981	2,692	1,144	1,380
	RACINE	173,132	6,518	2,770	3,560
	SHEBOYGAN	100,935	3,370	1,113	2,070
	VILAS	16,535	593	252	340
	WAUKESHA	280,326	10,398	4,419	5,770

AREA	EMPHYS	C/BRONCH	65+	CODE
VIRGINIA				
ARLINGTON	1,287	3,372	13,069	CO, O
CHESTERFIELD	1,220	3,200	13,396	O
FAIRFAX	5,001	13,106	50,788	O
HENRICO	1,567	2,141	15,906	O
LOUDON	535	1,382	5,430	O
PRINCE WILLIAM	1,290	3,382	13,103	O
ROANOKE	626	1,639	6,351	O
STAFFORD	344	900	3,489	O
ALEXANDRIA CITY	886	2,323	8,999	CO, O
CHESAPEAKE CITY	1,049	2,750	10,655	O
FAIRFAX CITY	181	474	1,834	O
FALLS CHURCH CITY	79	207	801	O
HAMPTON CITY	1,136	2,979	11,544	O
MANASSAS CITY	82	213	825	O
MANASSAS PARK CITY	61	159	616	O
NEWPORT NEW CITY	1,292	3,382	13,107	O
NORFOLK CITY	2,448	6,414	24,853	O
PORTSMOUTH CITY	945	2,477	9,598	O
RICHMOND CITY	1,883	4,934	19,121	O
ROANOKE CITY	821	2,153	8,343	O
SALEM CITY	238	711	2,340	O
VIRGINIA BEACH C	5,238	5,999	23,245	O
SUFFOLK CITY	421	1,104	4,275	
WASHINGTON				
TACOMA*	1,495	5,486	16,484	TSP, CO
SPOKANE*	1,615	5,927	17,815	TSP, CO
VANCOUVER*	234	1,482	4,455	TSP
SEATTLE*	4,568	17,092	51,360	TSP
WEST VIRGINIA				
BROOKE	332	753	3,983	TSP
HANCOCK	431	980	5,188	TSP
MARSHALL	435	988	5,224	TSP
OHIO	618	1,406	7,444	TSP
PUTNAM	378	860	4,550	
WISCONSIN				
BROWN	1,744	4,291	19,941	O
COLUMBIA	412	1,014	4,714	O
DANE	3,079	7,574	35,199	O
KENOSHA	1,220	3,001	13,946	O
MILWAUKEE	9,479	23,338	108,362	O
OZAUKEE	776	1,748	8,124	O
RACINE	1,724	4,240	19,698	O
SHEBOYGAN	1,018	3,544	12,099	O
VILAS	157	386	1,790	O
WAUKESHA	2,749	6,761	31,422	O

TABLE 3

CORONARY ARTERY DISEASE PAR
AREAS NOT IN ATTAINMENT WITH CO NAAQS

LOCALE	TP(000s)	PAR/CAD
ARIZONA		
PHEONIX	790	19,157
TUCSON	331	8,019
CALIFORNIA		
ALAMEDA	802	25,878
BUTTE	115	3,416
CONTRA COSTA	523	15,329
KERN	403	9,409
MARIN	178	5,245
NAPA	79	2,300
ORANGE	1,542	45,159
SACRAMENTO	624	18,279
SAN FRANCISCO	542	15,858
SAN JOAQUIN	277	8,077
SAN MATEO	469	13,737
STANISLAUS	212	6,191
COLORADO		
BOULDER	150	3,866
DENVER	388	10,053
DOUGLAS	19	478
JEFFERSON	293	7,614
DISTRICT OF COLUMBIA		
WASHINGTON	534	16,205

CORONARY ARTERY DISEASE PAR
AREAS NOT IN ATTAINMENT WITH CO NAAQS

LOCALE	TP(000s)	PAR/CAD
INDIANA		
PART OF MARION CO	765	18,263
KANSAS		
WICHITA, SADGEWICK	279	7,407
KENTUCKY		
JEFFERSON	533	16,596
MINNESOTA		
ANOKA	16	486
CARVER	3	89
DAKOTA	16	479
RAMSEY *	460	11,173
STEARNS *	108	2,628
ST LOUIS*	222	5,401
MISSOURI		
ST. LOUIS	75	2,567
MONTANA		
MISSOULA CO	76	1,719
NEBRASKA		
LINCOLN	172	4,258
OMAHA	314	8,278

CORONARY ARTERY DISEASE PAR
AREAS NOT IN ATTAINMENT WITH CO NAAQS

LOCALE	TP(000s)	PAR/CAD
NEW MEXICO		
BERNALILLO	32	877
NEW HAMPSHIRE		
NASHUA, HILLSBORO	68	1,650
NEW YORK		
KINGS	1,795	59,846
NEW YORK	1,149	38,316
RICHMOND	283	9,438
NORTH CAROLINA		
MECKLENBURG	319	9,526
OHIO		
CUYAHOGA	1,177	36,907
FRANKLIN	683	21,406
HAMILTON	687	21,506
JEFFERSON	72	2,251
LORAIN	216	6,775
LUCAS	371	11,607
MAHONING	227	7,103
MONTGOMERY	449	14,081
PENNSYLVANIA		
ALLEGHENY	1,181	41,202

CORONARY ARTERY DISEASE PAR
AREAS NOT IN ATTAINMENT WITH CO NAAQS

LOCALE	TP(000s)	PAR/CAD
TEXAS		
EL PASO CO *	**425**	**9,308**
VIRGINIA		
ARLINGTON	122	3,440
ALEXANDRIA	82	2,332
WASHINGTON		
SPOKANE	**171**	**3,999**
SUB-TOTAL	16,315	504,515
SUBSET TOTAL		126,399

LOCALE County or county subdivision not in attainment With NAAQS for carbon monoxide as of February 1, 1982 (standard type set) or Projected as unlikely to attain NAAQS by December 31, 1987 (expressed in boldface type) Asterisk indicates that identifiable subdivision of county designated as not likely to attain NAAQS by given dates.

TP(000s) Total Population Enumerated In 1980 Census For County Or County subdivision

PAR/CAD Estimated Population At Risk With Coronary Artery Disease (For details on computational methods, refer to Narrative Section II)

TABLE 4
PAR FOR PREGNANT WOMEN IN AREAS NOT IN ATTAINMENT WITH NAAQS FOR CARBON MONOXIDE

	LOCALE	TP(000s)	PAR/PRGW
ARIZONA			
	PHEONIX	790	14,531
	TUSCON	331	6,082
CALIFORNIA			
	ALAMEDA	802	18,791
	BUTTE	115	2,445
	CONTRA COSTA	523	1,111
	KERN	403	6,852
	MARIN	178	3,784
	NAPA	79	1,686
	ORANGE	1,542	32,856
	SACRAMENTO	624	13,317
	SAN FRANCISCO	542	9,985
	SAN JOAQUIN	277	4,862
	SAN MATEO	469	9,804
	STANISLAUS	212	4,520
COLORADO			
	BOULDER	150	3,262
	DENVER	388	8,469
	DOUGLAS	19	433
	JEFFERSON	293	6,394
DIST OF COLUMBIA			
	WASHINGTON	534	9,383

PAR FOR PREGNANT WOMEN IN AREAS NOT IN ATTAINMENT WITH NAAQS FOR CARBON MONOXIDE

LOCALE		TP(000s)	PAR/PRGWM
KENTUCKY			
	JEFFERSON	533	11,158
INDIANA			
	MARION CO	765	12,320
KANSAS			
	WICHITA	279	4,803
MINNESOTA			
	ANOKA	16	3,253
	CARVER	3	615
	DAKOTA	16	3,225
	RAMSEY	460	7,632
	STEARNS *	108	3,689
	ST LOUIS *	222	1,795
MISSOURI			
	ST. LOUIS	75	7,295
MONTANA			
	MISSOULA	76	1,376
NEBRASKA			
	LINCOLN	972	2,992
	OMAHA	314	5,468

PAR FOR PREGNANT WOMEN IN AREAS NOT IN ATTAINMENT WITH NAAQS FOR CARBON MONOXIDE

LOCALE		TP(000s)	PAR/PRGWM
NEW HAMPSHIRE			
	NASHUA	68	1,011
NEW YORK			
	KINGS	1,795	30,341
	NEW YORK	1,149	19,425
	RICHMOND	283	4,789
NORTH CAROLINA			
	MECKLENBURG	319	5,821
OHIO			
	CUYAHOGA	1,177	23,525
	FRANKLIN	683	13,645
	HAMILTON	687	13,709
	JEFFERSON	72	1,438
	LORAIN	216	4,316
	LUCAS	371	7,406
	MAHONING	227	4,545
	MONTGOMERY	449	8,976
PENNSYLVANIA			
	ALLEGHENY	1,181	19,431

PAR OF PREGNANT WOMEN IN AREAS NOT IN ATTAINMENT
WITH NAAQS FOR CARBON MONOXIDE

	LOCALE	TP(000s)	PAR/PRGWM
TENNESSEE			
	KNOXVILLE *	**175**	**7,195**
TEXAS			
	EL PASO	**425**	**8,165**
VIRGINIA			
	ARLINGTON	122	2,243
	ALEXANDRIA	82	1,517
WASHINGTON			
	SPOKANE	**171**	**3,999**
	TACOMA PIERCE	**156**	**2,599**
	SUB-TOTAL	16,315	326,169
	SUBSET TOTAL		**104,922**

LOCALE	County or county sub-division not in attainment with NAAQS for carbon monoxide as of February 1, 1982 (standard type set) or Projected as unlikely to attain NAAQS as of December 31,1987 (expressed in **boldface type**). Asterisk indicates identifiable subdivision of county designated as not likely to attain NAAQS by given dates.
TP(000s)	Total population base in thousands
PAR/PRGWM	Estimated Population At Risk Of Pregnant Women Residing In Area. (For details on computational methods, refer to Section II)

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AMERICAN LUNG ASSOCIATION
The Christmas Seal People ®

SULFUR OXIDES AND PUBLIC HEALTH:
EVIDENCE OF GREATER RISKS

Prepared by:

KAWECKI ASSOCIATES
Chevy Chase, Maryland

August 1983

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PREFACE

During the past two decades, researchers have found harmful health effects occurring at lower and lower levels of air pollution. This trend is attributed to our growing ability to measure and understand air pollution and its effects. Historically, the standards for safe amounts of sulfur oxides and particulate matter in the air were based primarily on the results of epidemiological studies. While controlled studies on humans showed some of the same kinds of health effects observed epidemiologically, the exposure levels required to evoke these responses were much higher -- subjects showed virtually no measurable response to sulfur dioxide at levels lower than 1 ppm or to sulfuric acid concentrations below 1000 $\mu g/m^3$. Today's research findings contrast sharply with these earlier controlled studies. Scientific journals report effects on pulmonary function from short-term exposure to sulfur dioxide at 0.25 ppm and to sulfuric acid at 100 $\mu g/m^3$, leaving little, if any, margin of safety for protecting sensitive individuals. Because these levels approach those that may occur in the ambient air, prudence dictates reexamination of the control strategies for sulfur emissions from the burning of fossil fuels.

INTRODUCTION

Sulfur is one of the most pervasive pollutants in the environment. In the United States alone, nearly 30 million tons of sulfur oxides, primarily sulfur dioxide (SO_2), are emitted annually into the atmosphere by burning fossil fuels. Although Federally mandated control programs have generally reduced SO_2 levels over the past 10 to 15 years, concentrations of this gas and associated sulfates remain elevated in some nonurban areas. This situation can only be worsened with the increased burning of high-sulfur fuels. Moreover, some control schemes may have made matters worse. Noteworthy is the use of tall smokestacks, intended to improve local air quality, which have created problems with long-range transport of sulfur pollutants. Recent evidence suggests that adverse effects from short-term exposure to sulfur compounds occur at levels much lower than those previously reported, indicating that the health of a large segment of the population may be in jeopardy.

CONCENTRATIONS

The combustion of coal and oil produces a variety of air pollutants, of which SO_2 is among the most abundant. Once emitted, this gas reacts in the atmosphere to produce compounds such as sulfuric acid (H_2SO_4) and sulfate salts, which exist as microscopic particles up to 50 times smaller than the diameter of a human hair. These particles form aerosols and remain suspended in the air for considerable lengths of time. As such, they may be carried by the winds hundreds of miles from their source.

Sulfate compounds dominate the mass of fine particles (those less than 1 μm in diameter) in most areas of the United States, averaging 35 percent of the total fine-particle mass.[1] The acidity of aerosol particles correlates closely with sulfate concentrations, with sulfuric acid comprising 20 to 45 percent of the total sulfate mass.[2,3]

Ambient air concentrations of fine particles have, at best, remained unchanged over the past several years; in many areas, increases have occurred. Generally, the highest levels occur during the summer months. These levels are driven upward by the sulfate component.[4-6]

Annual concentrations of sulfate particles in the United States average 9-13 µg/m^3, while levels twice as high may occur over large areas of the Northeast during the summer, lasting for 12 or more hours.[3,7-9] Moreover, the northeastern United States may also experience episodes during which sulfuric acid concentrations exceed 25 µg/m^3.[3] Thus, the Northeast may experience both annual and short- term elevations of sulfate pollution, particularly during the summer. Additionally, SO_2 concentrations are substantially higher than sulfate levels in large portions of the Northeast, but unlike sulfate, SO_2 levels are highest in the winter months. Nonurban average and peak ozone levels are also elevated in the Northeast, with the highest levels occurring during the summer months.[7]

HEALTH EFFECTS

To pinpoint and analyze the effects of pollutants, researchers conduct toxicological studies with experimental animals, clinical studies of humans exposed under controlled conditions, and epidemiological studies of large populations exposed under highly variable ambient conditions. Perhaps the most dramatic evidence of the hazards of sulfur dioxide and particulate matter in ambient air comes from studies of severe pollution episodes, such as those causing deaths in Belgium's Meuse Valley, in Donora, Pennsylvania, and in London. The worst London episode occurred in December 1952 when a "killer fog" of sulfur dioxide, sulfates, and smoke killed some 4,000 people in one week.

Health studies have focused on the impact of sulfur pollutants on the clearance of foreign matter from the respiratory tract and defenses against infectious agents, respiratory mechanics, aggravation of respiratory and cardiovascular disease, and mortality. While many laboratory studies have used unrealistically high concentrations in investigating these effects, this paper primarily reviews research dealing with exposure in the ambient air range. In addition, because this report is a summary of the potential hazards associated with the long-range transport of sulfur oxides, only a sample of the voluminous material available is reviewed here. Emphasis is placed on the findings of the recent Air Quality Criteria for Particulate Matter and Sulfur Oxides[10], supplemented by the latest reported research.

The next section of this report describes how sulfur pollutants enter and become deposited in the respiratory system. This section is followed by a review of pertinent health-effect studies of sulfur compounds singly and in combination with other air pollutants. Subsequent sections estimate risk and draw conclusions about effects on human health.

Biological Dose and Uptake

The respiratory system is the major route of entry for air pollutants. When pollutants are inhaled, the material is distributed to various regions of the respiratory tract (see figure 1). The effects of the retained pollutants depend upon their form (e.g., gas vs. aerosol), interaction with other pollutants, and biochemical and physiological characteristics of the lung.

SO_2 is readily absorbed on the moist surfaces of the nose and upper respiratory passages, reducing the amount of penetration into the deep lungs. For example, at a concentration greater than 1 part per million (ppm), SO_2 is almost completely absorbed in the nose during rest. Penetration into the lower respiratory tract increases with

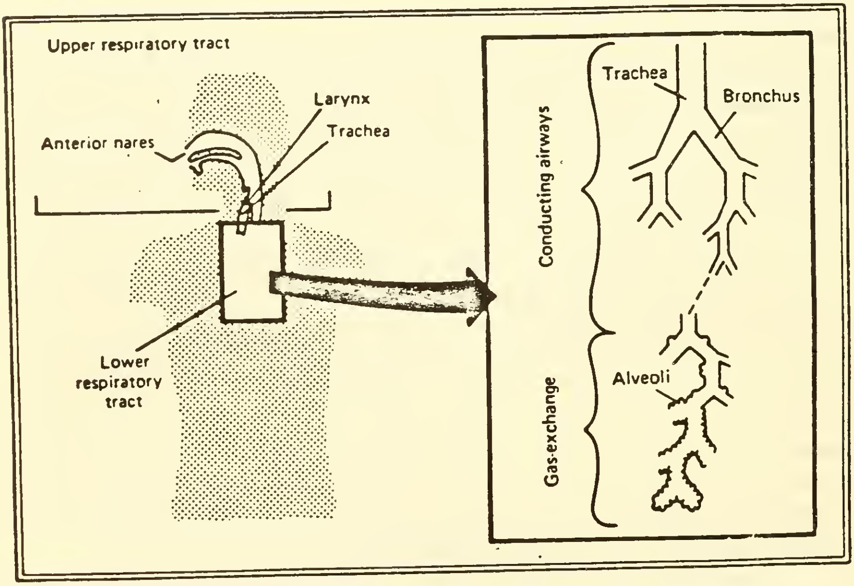


Figure 1. Diagrammatic representation of the human upper and lower respiratory tract.[12]

mouthbreathing, elevated breathing rates, and the presence of particles in the air (which act as carriers).[11] Once absorbed in the moist linings of the upper airways, SO_2 goes through a series of chemical reactions to form sulfates, which are eventually secreted.

The penetration of particles into the respiratory tract varies with particle size. Particles less than 1 µm in diameter, which include sulfate particles, are deposited throughout the lung, but larger particles tend to be trapped in the upper airways. Once inhaled, some types of particles absorb water and can grow from less than 1 µm in diameter to 4 µm in diameter. About 5 to 25 percent of these particles are deposited in the upper and middle airways (tracheobronchial region), while about the same percentage of smaller particles are deposited in the deep lung (alveolar region).[10] As with SO_2, the deposition pattern is affected by the type of breathing: Inhalation by mouth permits greater penetration than does breathing by nose, since the former is a much less effective "scrubber" than the latter.[7] But on the other hand, mouthbreathing tends to neutralize sulfuric acid, owing to the presence of ammonia in the mouth cavity.[13,14]

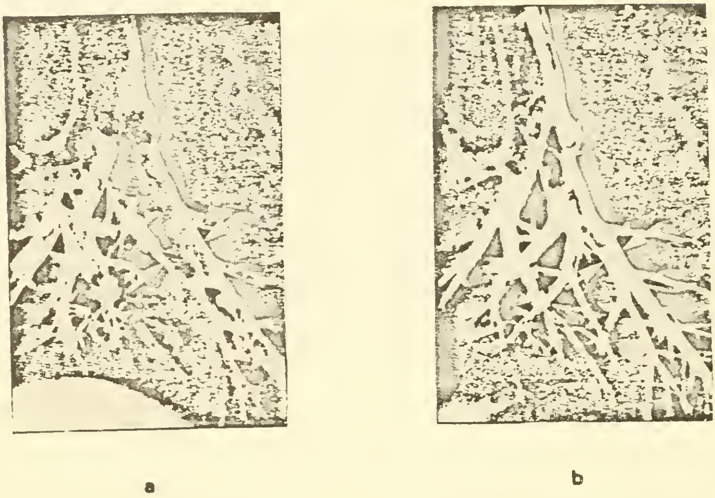
SO_2 is absorbed by certain types of particles in a way that may potentiate its effects. Further, the gas is transformed into sulfur trioxide in the air and (in combination with moisture) forms sulfuric acid. H_2SO_4 droplets can be converted to sulfates in the presence of ammonia in the ambient air.

Toxicological Studies

Although inhaled sulfur compounds readily enter the circulatory system, their main effect occurs in the respiratory tract. Animal studies indicate that the most likely effect of 1-hour exposure to sulfur dioxide levels such as may occur during peak air-pollution episodes is narrowing of the bronchial air passages (bronchoconstriction) (figure 2). This response, which may be due to reflexive contraction of the muscles in the bronchus, apparently involves release of acetylcholine or histamine.[15-17]

The animal studies listed in table 1 indicate that exposure to SO_2, sulfate particles, or H_2SO_4 affect the mechanisms by which the respiratory tract clears itself of foreign matter.[18-25] When sulfuric acid is combined with ozone, increased susceptibility to infections has been observed; when combined with carbon, which also occurs in ambient air, increased mortality has been seen in mice.[26,27]

Figure 2. The photographs depict the narrowing of the airways in the lungs of a dog: (a) before and (b) after bronchoconstriction.[32]



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Sulfuric acid generally appears to be more irritating than any of the sulfate salts, whose toxicity varies with chemical composition. Guinea pigs show increases in airway resistance in response to short-term exposure to sulfuric acid at a concentration of 100 $\mu g/m^3$.[28,29] This degree of sensitivity to low levels of sulfur oxides has not been observed in other animal species, but has been observed in humans.[16,30,31]

The effects of chronic exposure to sulfuric acid and sulfates are less certain than those of acute exposure, but various responses have been observed, including changes in respiratory mechanics.[33,34] Duration of exposure, particle size, and chemical composition all appear to be important in determining changes in pulmonary function at low concentrations.

TABLE 1
LABORATORY STUDIES

Substance	Subjects	Exposure	Effect	Reference
Animal Toxicology				
Sulfuric acid	Guinea pigs	100 $\mu g/m^3$, short-term	Increased airway resistance.	28,29
Sulfuric acid	Various experimental animals	100 $\mu g/m^3$, short-term	No increase in airway resistance.	30,16
Sulfuric acid	Guinea pigs	100 to 1000 $\mu g/m^3$, long-term	Altered respiratory mechanics.	33
Sulfuric acid	Monkeys and other animals	$\geq 190\ \mu g/m^3$, short- and long-term	Altered mucociliary clearance.	20-24
Controlled Human Studies				
SO_2	Asthmatics	0.25, 0.5, and 1.0 ppm	Bronchoconstriction in some subjects at all exposure levels; wheezing and shortness of breath in some subjects.	17,38-41
SO_2	Asthmatics	0.25 ppm	No bronchoconstriction.	42
SO_2 and cold, dry air	Asthmatics	0.5 ppm	Significant change in pulmonary function.	43

TABLE I (continued)

Substance	Subjects	Exposure	Effect	Reference
SO_2	Humans	1, 5, and 25 ppm	Increased incidence of colds within 1 week of exposure to virus.	44
SO_2	Humans	>1 ppm	No increased incidence of colds after exposure to virus.	45
SO_2	Healthy adults	1.0 to 2.5 ppm	Possible broncho-constriction.	35-37
SO_2	Humans	1-3 ppm	Changes in pulmonary function.	46
Sulfuric acid	Normal and asthmatic subjects	75 $\mu g/m^3$	Pulmonary function changes in 2 of 12 subjects; no group response.	86
Sulfuric acid	Asthmatic adolescents	100 $\mu g/m^3$	Significant changes in pulmonary function.	31
Sulfuric acid	Humans	100, 300, and 1000 $\mu g/m^3$	Tracheobronchial clearance increased at 100 $\mu g/m^3$, decreased at 1000 $\mu g/m^3$, no change at 300 $\mu g/m^3$.	48
Sulfuric acid and ammonium bisulfate	Asthmatic adults	500 $\mu g/m^3$	Reduced airway resistance and forced expiratory volume.	49

TABLE 1 (continued)

Substance	Subjects	Exposure	Effect	Reference
Mixed Pollutants				
SO_2 with O_3	Humans	0.37 ppm (SO_2), 0.37 ppm (ozone), for 2 hours	Increased severity of respiratory symptoms and pulmonary function changes caused by ozone alone.	50,51
SO_2 with O_3	Normal and asthmatic subjects	0.37 ppm (SO_2), 0.37 ppm (ozone), for 2 hours	Some measures of lung function showed effects over those of ozone alone.	57
SO_2 with O_3	Young men	0.4 ppm each, at $\geq 25^{o}C$ and $\geq 45\%$ relative humidity	No synergistic effects.	54,56
SO_2 and NO_2	Normal and asthmatic subjects	0.5 ppm each	No synergistic effects.	42
SO_2, NO_2, and O_3	Healthy humans	5.0 ppm (SO_2), 5.0 ppm (NO_2), 0.1 ppm (ozone)	No synergistic effects.	61
SO_2 with inert particles	Humans	5 ppm	Reduced mucus flow rates	47
Sulfuric acid, O_3 and carbon particles	Mice	900 $\mu g/m^3$, (H_2SO_4), 0.1 ppm (O_3), short-term	When combined with ozone increased susceptibility to infection; when combined with carbon, increased mortality.	26,27

Human Clinical Studies

Clinical studies with human subjects allow researchers to investigate the responses of both healthy and special at-risk individuals to different modes and durations of exposure. Such studies have shown that SO_2 affects various physiological functions, including sensory processes, perceptions of irritation or pain, and respiratory function. The health significance of sensory responses appears to be minor. In healthy subjects at rest, respiratory and cardiovascular responses have been consistently observed at exposure levels of 5 ppm. The findings of several investigators suggest potentiation of SO_2's airway effects with mouthbreathing and increased exercise levels, or both. Studies suggest bronchoconstriction in healthy adults orally breathing SO_2 concentrations of 1.0 to 2.5 ppm.[35-37]

Of greater concern is the impact of SO_2 on hyperreactive individuals--those particularly susceptible to airway constriction. Such individuals include asthmatics and persons with disorders such as hay fever and other allergies.

Systematic study of the effects of SO_2 on asthmatics was initiated in 1980, when researchers observed bronchoconstriction, sometimes with wheezing and shortness of breath, at concentrations less than 1.0 ppm. In some asthmatics, bronchoconstriction occurred at levels as low as 0.25 ppm.[17,38-41] In another study, however, no effects were noted at 0.25 ppm.[42] Recently reported research shows that 0.5 ppm SO_2 (the lowest level administered) potentiated the response of asthmatics to cold, dry air.[43] This group of experts concluded that "people with asthma may be more sensitive to the bronchoconstrictor effects of ambient SO_2 in cold, dry environments than in warm, moist environments."

The heightened response of asthmatics to SO_2 may be due in part to increased respiration caused by the initial irritancy of the gas. The findings that people with asthma and disorders such as hay fever are more sensitive to SO_2 and that this sensitivity is increased by mild exercise are consistent with the theory that bronchial hyperreactivity is in part associated with an increase in reflexive responses in the airways.

Mixed results have been reported on the effects of SO_2 on clearance in humans. An increased incidence of colds has been noted within one week of exposure to 1, 5, and 25 ppm SO_2.[44] Although the same researchers later noted no increase in colds in subjects exposed to SO_2 and a rhinovirus, it was noted that the virus was innoculated in a region of the nose where clearance is unaffected by SO_2.[10,45] In other work, recovery from mild upper respiratory infections was impeded in subjects exposed to

5 ppm SO_2 for several days.[46] With combined SO_2 and particle exposure, nasal mucus flow rates were reduced at 5 ppm and greater concentrations.[47]

Inhalation of sulfuric acid mist (0.35 to 5.0 mg/m^3) increases respiratory rate and decreases airflow rates and breathing volume, according to some studies with healthy adults. Other studies have indicated that pulmonary function is almost totally unaffected by 0.1 to 1.0 mg/m^3 sulfuric acid for 10 to 120 minutes. One researcher found that the bronchoconstrictor action of carbacol was potentiated by sulfuric acid and sulfate aerosols generally in proportion to their acidity. One study found that mucociliary clearance of the trachea and bronchus was increased at 100 µg/m^3 sulfuric acid, unaltered at 300 µg/m^3, and decreased at 1000 µg/m^3.[48] The decreased clearance rates, while transient, raise the possibility of more persistent or chronic depression of clearance with repeated exposure to the same concentrations of sulfuric acid.

In studies with asthmatic subjects, changes in airway function have been demonstrated after exposure to sulfuric acid at concentrations less than 1000 µg/m^3. At 500 µg/m^3 and higher, reduction in airflow and the volume of air that can be exhaled have been observed in adult asthmatics after sulfuric acid and ammonium bisulfate exposures.[49] In a group of adolescent asthmatics exposed at rest for only one-half hour, followed by 10 minutes of moderate exercise, significant changes in pulmonary function occurred with a sulfuric acid concentration of 100 µg/m^3.[31]

An important question is whether SO_2 and sulfuric acid interact synergistically with other air pollutants, particularly ozone--that is, whether the effects of these combined pollutants are greater than the sum of the effects of each alone. A few studies have reported such synergistic effects on respiratory symtoms and pulmonary function. But the results of these studies have been questioned on statistical and methodological grounds.[50-53] Other researchers have found no evidence or limited evidence of synergistic effects between ozone in normal subjects between SO_2 and NO_2, or between SO_2, NO_2, and ozone.[54-61] The question remains unresolved.[11]

Epidemiological Studies

Several epidemiological investigations of air pollution episodes in London during the 1950's and 1960's are summarized in Table 2. Collectively, they appear to provide a reliable basis on which to estimate ambient air levels of SO_2 and particles at which

TABLE 2
EPIDEMIOLOGICAL STUDIES OF ACUTE EXPOSURE TO AMBIENT AIR LEVELS OF SO_2 AND PARTICULATE MATTER* IN LONDON[10]

Type of study	Effects observed	24-hr average pollutant level ($\mu g/m^3$) Particulate matter	SO_2	Reference
Mortality	Clear increases in daily total mortality above a 15-day moving average among the elderly and persons with preexisting respiratory or cardiac disease during the winter of 1958-59.	≤1000	≤1000	82,87
	Analogous increases in daily mortality during 1958-59 to 1971-72 winters.			88
	Some indications of increases in daily total mortality during the 1958-59 winter, with greatest certainty of increases occurring at particulate and SO_2 levels above 750 $\mu g/m^3$.	500-1000	500-1000	82
	Analogous indications of increased mortality during 1958-59 to 1971-72 winters, again with greatest certainty at particulate and SO_2 levels above 750 $\mu g/m^3$ but indications of small increases at particulate levels <500 $\mu g/m^3$ and possibly as low as 150-200 $\mu g/m^3$.			88
Morbidity	Worsening of health status among chronic bronchitis patients during winters from 1955 to 1960.	≤250-500*	≤500-600	89, 90
	No detectable effects in most bronchitics; but worsening of health status among highly sensitive chronic bronchitis patients during 1967-68 winter.	<250*	<500	90

*Concentrations of particulate matter were measured by the British Smokeshade method.

acute effects may occur among groups at risk. The elderly and persons with preexisting cardiorespiratory disease seem to be at greatest risk for acute exposure effects.

However, great care must be exercised in extrapolating from the observed exposure-effect relationships to what might be expected to occur at other times or geographic locations. High humidity levels (fog conditions) occurring jointly with prolonged simultaneous elevations of particles and SO_2, for example, may be required before the most marked mortality effects encountered in London would recur.

Table 3 summarizes studies of chronic exposure to particles and SO_2. The first study listed in the table demonstrates that increased risk for respiratory symptoms and pulmonary function decrements among young children is associated with long-term exposures.[62] However, no clear threshold levels can be discerned from this study, and the possibility of increased risk at such levels can not be confirmed or denied without additional data. The absence of detectable effects 3 years later in the same children or in other children of the same age tends to suggest that such risks are

TABLE 3
EPIDEMIOLOGICAL STUDIES OF CHRONIC EXPOSURE TO AMBIENT AIR, PARTICULATE MATTER, AND SO_2 [10]

Effects observed	Annual average pollutant levels ($\mu g/m^3$) Particulate matter	SO_2	Reference
Likely increased frequency of lower respiratory symptoms and decreased lung function in children in Sheffield, England.	230-301[a]	181-275	62
Apparent improvement in lung function of adults in association with decreased particulate pollution in Berlin, NH.	180[b]	<25-50[c]	63,64
Apparent lack of effects and symptoms, and no apparent decrease in lung function in adults in Berlin, NH.	80-131[b]	<25-50[c]	63,64

[a] Concentration of particulate matter measured by the British Smokeshade method.
[b] Concentration of particulate matter measured as total suspended particles by high-volume sampling.
[c] Estimated.

minimal at exposure levels lower than those shown. The other studies listed in the table involved investigation of small groups of subjects at brief intervals over several years.[63,64] Also, the improvements in lung function noted in subjects from one time to another (apparently as particulate levels decreased) represent only a modest basis on which to estimate ambient levels for health effects in the general population.

Between 1967 and 1975, a series of studies was conducted to assess the effects of air pollutants on communities. The U. S. Environmental Protection Agency titled a portion of these studies the Community Health and Environmental Surveillance System (CHESS). These studies indicated that acute aggravation of asthma and other symptoms in the elderly were associated with 24-hour exposure to sulfate levels of 10-15 $\mu g/m^3$ and SO_2 levels of 200-300 $\mu g/m^3$. Chronic effects were observed at SO_2 levels of 200-400 $\mu g/m^3$, sulfate levels of 7-20 $\mu g/m^3$, and particle levels of 60-165 $\mu g/m^3$. Unfortunately, CHESS studies were defective in design, methodology, and execution. Nevertheless, together they corroborate the notion that elevated levels of SO_2, H_2SO_4, and other particulate matter can be harmful.

ESTIMATES OF RISK

The evaluation of public health risks from air pollution is a seemingly straightforward matter--a series of dose-response relationships are applied to a set of pollution measurements of population exposure. These determinations, however, are subject to considerable disagreement within the scientific community. Effect thresholds, response measures, and dosage estimates are some of the issues debated by pollution researchers. Confounding factors in studies of persons exposed to air pollution include cigarette smoking, activity levels of individuals, and exposure levels indoors vs. outdoors. Still, while opinions differ on the magnitude of effects from exposure to air pollutants, the concensus is that increased air pollution, and in particular increased SO_2 emissions, will be associated with worsened health of the general public. Under severe pollution conditions, each incremental $\mu g/m^3$ increase in sulfate levels may cause 100,000 to 1,000,000 excess deaths in the population, according to various risk estimates.[3,65-67]

To provide a basis for evaluating mortality risk analyses, the following information is noteworthy. Chronic obstructive lung disease, bronchitis, and emphysema accounted for about 2.5 percent of all deaths in the United States.[68] In 1977, these diseases accounted for about 45,000 deaths, a 22-percent increase in the age-adjusted rate since 1968. This rate contrasts sharply with an 18-percent decline in death rates from all causes and a 22-percent decline in deaths from heart disease. By recombining data from the 8th ICDA Revision (1968-78) with the 9th ICDA Revision (1978 to present), the statistics show this group of diseases ranking 5th among leading causes of death in the United States.[68] While cigarette smoking is the primary cause of death from these diseases, it does not fully account for this inverted rate.

POPULATIONS AT RISK

The estimated prevalence of chronic obstructive lung disease (primarily bronchitis, emphysema, and asthma) in the United States is reported in the National Center for Health Statistics (NCHS) National Health Interview Surveys of 1970, 1978, 1979, and 1980 (Tables 4 and 5). Chronic bronchitis, emphysema, and asthma combined accounted for over 16 million cases in 1979. Various estimates have been reported on the number

TABLE 4

ESTIMATED ANNUAL PREVALENCE OF SELECTED CHRONIC RESPIRATORY DISEASES REPORTED IN HEALTH INTERVIEWS, UNITED STATES, 1970, 1978, 1979, and 1980.

The percent prevalence rate is given parenthetically for 1970 and 1979 Survey Data* (Number of cases in thousands)

Disease	1970[70]	Rate %	1978[68]	1979[91]	Rate %	1980[92]	Estimated % increase
Chronic bronchitis	6,526	(3.3)	7,064	7,474	(3.5)	7,869	0.2
Emphysema	1,313	(0.7)	2,068	2,137	(1.0)	2,476	0.3
Asthma	6,031	(3.0)	6,035	6,402 8,900[69]	(3.0)	6,802	--
Hay fever and other upper respiratory allergies	10,826	(5.4)	15,516	15,620 26,500[69]	(7.0)	--	1.6

*1970 and 1978 estimates are based on the 8th Revision of the International Classification of Diseases, Adapted. (Chronic Bronchitis 490, 491; Emphysema, 492; Asthma, with or without hay fever, 493.) 1979 and 1980 estimates are based on the 9th Revision. Estimates for 1970 are derived from the entire sample of households; those for 1978, 1979, and 1980 are derived from a 1/6 subsample of households.

TABLE 5
PREVALENCE OF CHRONIC RESPIRATORY CONDITIONS BY SEX AND AGE FOR 1979[91]

Condition	Number of cases, in thousands					% of U.S. population
	Total	Male	Female	<17 years old	>65 years old	
Chronic bronchitis	7,474	3,294	4,180	2,450	1,059	3.5
Emphysema	2,137	1,362	775	13*	990	1.0
Asthma	6,402	3,110	3,291	3,154	1,181	3.0
	8,900[69]					4.0
						0.5-6.6[68]
Hay fever and other upper respiratory allergies	15,620	7,031	8,559	3,154	1,181	7.0
	26,500[68]					12.0

*Estimates below 215,000 are considered statistically unreliable.

of cases of chronic obstructive lung disease. Data collected by the NCHS National Health and Nutrition Examination Survey I in 1971-74 showed that an estimated 7.6 percent of the adult population 18 through 74 years of age reported asthma, emphysema, or chronic bronchitis.[69] The NCHS reported that approximately one-third of the chronic bronchitics and one-half of the asthmatics were under 17 years of age.[70] Evidence of increased sensitivity in asthmatics has been widely reported.[17,31,38,40-43,71]

Infants, children, adolescents, and the elderly comprise the largest sensitive subgroup. Approximately 62.5 million people are under 17 years old and 46.3 million are under 14 years old. In very young children the immune system is immature and thus offers incomplete protection from exposure to sulfur oxide gases and particles. In addition, because children spend more time outdoors and are more active than adults, they have greater exposure to ambient air pollutants and, probably, experience greater doses because of higher ventilation rates from heightened activity. The effects in children associated with particulate matter and sulfur oxides have been reported by many researchers.[72-77]

Approximately 24.6 million people are 65 years of age or older. In addition to immunulogical deficiencies, many elderly have reduced lung elasticity, and all elderly have lost some lung function, making them more susceptible to elevated levels of these air pollutants.[78-80] Death and illnesses in the elderly during air pollution episodes have been reported in several studies.[81-83]

Finally, because of increased particle penetration, mouthbreathers and oronasal breathers are a high-risk group. Current estimates indicate that this group includes about 15 percent of the population.[84,85]

CONCLUSIONS

The efforts by federal, state and local authorities to reduce pollution of the air by sulfur oxides have achieved mixed results. While concentrations of sulfur oxides near emission sources have lessened considerably, concentrations of SO_2 and its transformation products, sulfuric acid and other sulfate species, many miles away from these sources have, at best, remained the same and, in certain areas of the United States have even increased. So much attention on the long-range transport of sulfur pollution has been given to ecological effects--acid rain--that many have overlooked the effects on public health that this long-range transport poses.

The observed effects on asthmatics of SO_2 at 0.25 to 0.5 ppm and of H_2SO_4 at 100 $\mu g/m^3$ should be taken into account in making decisions regarding control strategies for SO_2. Temporary small changes in pulmonary function in healthy adults exposed to SO_2 levels of 1.0 ppm or H_2SO_4 levels of 1,000 $\mu g/m^3$ are of less concern than effects observed in asthmatics at much lower concentrations. These effects are likely to occur at SO_2 and sulfate levels in the ambient air. Their seriousness is reflected by the fact that airway obstruction and symptoms such as wheezing and dyspnea are among factors considered by physicians in determining the need to hospitalize asthma patients.

Relatively high concentrations of SO_2 and sulfuric acid have been reported in the Los Angeles basin area and in the northeastern United States. During the summer season in the Northeast, levels of sulfuric acid/sulfates range from 15 to 20 $\mu g/m^3$, while peaks of 25 $\mu g/m^3$ and higher are not uncommon. During this time, ozone levels are also elevated. Moreover, the potentiation of SO_2-induced bronchoconstriction by cold, dry air raises equal concern during the winter season, when SO_2 levels reach their highest, for example, in the Northeast.

Both the elevated sulfate and SO_2 concentrations combined with elevated ozone levels increase the health risks to those people with preexisting illnesses, those spending time out of doors, and those engaged in outside physical activity. This group includes asthmatics, people with allergies, those with chronic obstructive lung disease and cardiovascular disease, those involved in outdoor occupations, children, and the elderly. During the summer season, as noted previously, both children and the elderly are particularly sensitive to exposure to sulfate air pollution. During the winter season, these same groups are particularly sensitive to exposure to SO_2. While it is difficult to estimate the number of people affected by SO_2 and sulfuric acid aerosols, a variety of respiratory-related illnesses are likely to occur in sensitive populations during peak concentrations.

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Mr. Waxman. Thank you very much for that testimony. The reports that you have to attach to your testimony will be made part of the record.

Let me see if Jerry Anderson has come into the chambers. If not, Mr. Anderson was going to testify and we will have his written testimony made part of the record.

Let me thank each of you for the testimony that you have given. And let me tell you that I am very heartened by what you all have had to say. We have had here on this panel representatives of the public health concern, the environmental interests, people involved in the sporting industry, and the utilities, all indicating together that acid rain is a national problem in need of a national solution.

I want to particularly commend the Northern States Power Co. and Municipal Utilities Association for taking the lead and being the first utilities to come before the subcommittee and support the national acid rain control legislation. Your testimonies will be extremely helpful to us, and you have raised different legitimate concerns as to how we ought to handle the legislation, with some suggestions for changes. We are going to look at those suggestions very, very carefully and evaluate the legislation as we go along. We will to keep in touch with you as we go along in moving this legislation forward.

Mr. Sikorski.

Mr. Sikorski. Thank you, Mr. Chairman. I too would like to commend the entire panel for their very valuable testimony. I thought I had read a lot, especially on the Minnesota facts and figures. But it doesn't make any difference. You can still get more and more. It is much more alarming than many Minnesotans think.

Paul, you mentioned, not in your written statement was the 5 to 7 percent. Can you highlight that for the record, the comment that recently a study disclosed there is 5 to 7 percent potential for death.

Mr. Hansen. I think the best thing I could do with that, Jerry, would be to refer you to Tom Klein who is here today who was at that meeting and gave me that information just before the meeting if you would like to do that. Tom Klein here in the audience has that information. I don't have all, but that one line that he gave me here this morning.

Mr. Sikorski. If we could, maybe Tom Klein could tell me.

Mr. Waxman. Please come forward and take a seat.

Mr. Klein. I am Tom Klein, I am director of the Olsen Environmental Institute, which is in Ashland, Wis. As Paul mentioned, last week two forest service researchers, Sandy Verey and Dale Nichols, who are with the Northcentral Experiment Station in Grand Rapids, Minn., made the prediction that—they didn't have the year span, but they certainly weren't thinking of 30-40-50 years. They were thinking is probably a 10- to 20-year frame, that with current rates of acidic deposition, we would see 5 to 7 percent of the lakes in the Upper Peninsula of Michigan and northern Wisconsin, they did not say for Minnesota, they felt that some of the northeast Minnesota lakes were better protected than those in the UP and Wisconsin and that the rainfall is slightly more acidic in those areas.

They also added, and I think this is of great importance for the subcommittee, that if acidic deposition were to double in intensity, which is just a point three depression on the pH scale, which is certainly possible if SO_2 emissions were to somehow increase, we would see a 15- to 25-percent acidification rate in that same area. So the need to hold the line is critical in their view.

Mr. Sikorski. On that point, we have heard a lot of talk about some government officials and regulators, Canadians, as well as Americans, about cutting SO_2, stopping acid rain.

But two things have occurred recently. One is putting into operation the Atikokan plant, which directly affects northeastern Minnesota and the upper parts of Wisconsin and Michigan. Second, the approval or preliminary approval by Wisconsin of a new tall smokestack out at Green Bay, that runs counter. It is hypocritical to talk on one side of your mouth about needing to control acid rain and then talking out of the other side of your mouth about, well, we need this powerplant in Canada, and we need this smokestack in Green Bay. That runs counter to your concerns, I take it.

Mr. Klein. Well, it certainly doesn't—if I could comment on at least the Wisconsin situation, Mr. Sikorski. At a hearing this last week in Woodruff, Wisconsin Senator Strohl, a Wisconsin Senator, had a hearing on a bill he has introduced to have an emissions cap in Wisconsin, which would in fact preclude the tall stacks scenario from developing in Green Bay.

I don't believe that decision is by any means final, although it has been hotly contested in the State. I think there could be some political movement in Wisconsin toward the cap notion. As far as the Atikokan plant, obviously, that is a different situation. But those predictions were based on current levels and any increase will be extremely hazardous given that local sources, the 100- to 200-mile range, are very important.

The long-range transport is indeed part of the big picture. But the closer the source, the more damage it has on those sensitive ecosystems.

Mr. Sikorski. Thank you. Bill, Greg, or Mike, I think you come out front and have brought the industry out of the closet on this critical issue and joined by others. I know the REA's, several of the REA's, and I think their association is—at least the regional association here have joined with you in expressing a concern about acid rain as well.

So it is nice that Minnesota has not only been in the forefront in terms of control, in terms of past efforts by its industry and educators in legislature, but also now in terms of the national effort, both in the Senate and the House, and with the testimony here.

I have a problem in analyzing some of the recommendations, and alternative recommendations, to H.R. 3400, especially as it relates to the funding mechanism. Of course, that is the most complex and the most controversial part of our proposal. According to Business Week ours is a $20 billion bill. It is the least expensive. The most recent Senate emissions tax proposal costs $40 billion, almost twice as much.

One analysis has been done saying $10 billion of that additional $20 billion, would result in administrative costs. And, the emissions tax proposal offers less for Minnesota than what we are proposing.

At least under our bill consumers are going to benefit from the cleanup process.

But that aside, $10 of that $20 extra billion is because of the nature of an emissions tax nightmare that is associated with trying to fine. Right now under the current Clean Air Act it is virtually impossible, in fact, it is impossible, to discover every source and to monitor that source, and to set up an administrative structure to fund a national cost-sharing mechanism. Every guess from people that are familiar with this type of approach say we would have another IRS type agency that would break down in terms of its operation.

I guess I am asking you, especially when you talk about cost effective mechanisms, whether or not there is an inconsistency here, and whether emissions approach is worth $10 billion just to pay for using that approach. Think what we can buy with $10 billion.

Mr. GREGERSON. Mr. Chairman, Congressman Sikorski, I think many of us here would say that any national tax is a nightmare.

I have heard so many numbers sent out you can't really tell in the killowatt hour tax or an emissions tax concept or any other concept what the actual dollar amount to customers are. All of the utilities in the state of Minnesota have been trying to analyze both proposals and prepare a final list for PCA on what those costs are.

But I think one of the basic fundamental concepts that we wanted to see happen was a turn around to where utilities were given some incentives to reduce. We are a regulated industry. We have things such as the Clean Air Act and a lot of other regulations that put limits on us.

But I thought if there had to be a tax put on the national basis to support clean up of sulfur dioxides, I think it may help turn the industry around a little, make them look a little more forward, get a few more of them out of the closet, if you will. If you said to them, hey, we are going to tax you for a while, but you try and cut back and you do even more than you are required to, it is going to have some payback to it. That is where we are coming from.

Mr. SIKORSKI. I embrace that. I think it is a fine environmental ethic. And as we have heard testimony repeatedly that this is the way we based our proposals. But at some point you have got to—if I can compete with the worst fishing puns of the day, you have got to fish or cut bait. Paul wins on that one.

If we are serious about controlling acid rain, serious about protecting our environment and economic resources, and we want to do it as cheaply as possible, and get something that works, then that emissions tax is a very scary proposal. It is scary in the sense that no one has been able to say it works—even the people who have drafted and who have worked with these types of proposals. And it won't work, certainly, without a lot of money. I guess my question is whether the cost is worth it just to have that philosophy?

Mr. RADIO. Mr. Chairman, Representative Sikorski, I will just try to speak up rather than fight the grinches that keep pulling the microphone. I don't think that what we suggest is contradictory at all. I think the key words are we are proposing the emissions tax where it is feasible and where it is identifiable.

What we are saying is rather than just place it on the electric utility industry, there is the steel industry and other people like that that are large contributors to the problem also, and that we shouldn't start out with legislation that restricts it simply to electric utilities.

Mr. SIKORSKI. In that process would you support continuous monitoring of the sources in the country in order to determine where those sources are and the tax that would be appropriate for the funding? You also talk about a full funding mechanism. It means you have a goal in terms of dollars. It means you have to monitor in terms of debate, and then you have a coefficient to get these dollars.

Are you going to support the cost of the system of monitoring to get those numbers?

Mr. RADIO. Well, without knowing the real technical end of it, I would think you would have to do some monitoring. But that is also why we have proposed the two-phase program, so that you have a chance to stand back at some point as you cleaned up the most obvious ones and the easiest ones, frankly, to clean up to take a look at where you go from there.

Mr. SIKORSKI. Bill, I forgot. You have how many members?

Mr. RADIO. Ninety-six.

Mr. SIKORSKI. And they have how many plants, fossil-fueled power plants?

Mr. RADIO. In terms of plants?

Mr. SIKORSKI. Yes.

Mr. RADIO. Well, we represent 500,000 people. But in terms of plants, I think two-thirds of our members.

Mr. SIKORSKI. About 70 maybe?

Mr. RADIO. Yes.

Mr. SIKORSKI. Sixty to 70? Do you have any idea how much the cost would be to monitor those plants for SO_2, NO_x?

Mr. RADIO. No, sir. I don't. But I would also add for your information that I don't think there is any of those plants that operate on a 24-hour-a-day basis anymore either.

Mr. SIKORSKI. That's an additional complexity. That is part of this problem with the emissions proposal.

Mr. GREGERSON. Mr. Chairman, Congressman, I think that everybody realizes that any implementation is going to be difficult. There are state implementation plans available. There are emission inventories available. Our coal plants that don't have continuous emissions monitors use coal analysis to submit reports on annual inventories. I just think we need to slow down enough to take a look at this to see what is going to work out and provide some positive incentives for the future.

There was expediency used when we had tall stacks put on in the Midwest back in the early 1970's. I just would urge you to take the time to look at this to see. I have heard Congress can do impossible things.

Mr. SIKORSKI. Requests for those tall smoke stacks didn't come from the public policy makers. There is a system of data gathering now. It is a very incomplete system, especially in something as sensitive and as potentially controversial as taking money out of someone's pocket for electricity, or for anything else, any other consumer product that is produced through that SO_2 process.

It wouldn't be, I don't think, appropriate for—or sufficient for taxing data base at this point. Beyond that, if you rely on regional systems of data gathering you have the potential of setting an enforcement procedure. You have the potential of setting region against region in terms of dollars and cents, which we already have.

We hear it here in Minnesota. If you look at Federal moneys going out and coming back, we heard it last week in New York. If the Minnesota data, which I would guess is a lot better than in most other States or all other States, chances are Minnesota consumers are going to get taxed more because there is less fudge factor available to the taxing mechanism.

So that is one more of the little nightmares that are associated with that approach. We have got to think that process out before we embrace it as a good solution.

Thank you.

Mr. WAXMAN. Thank you. Did you want to volunteer one other comment?

Mr. HANSEN. I have one comment, if I could, Mr. Chairman, on this subject. Speaking as someone who lives in Ohio and someone who is working on acid rain in the Midwest, I think if the emissions tax approach, we won't know exactly how the allocations will be divided in all cases.

We don't know where the costs will fall in all cases. In my section of the country it will make it completely impossible to get support from Congressmen in an area, if you can't tell them at that time how much it is going to cost their region. I think that that is a big shortcoming of the emissions tax approach, even though, as I mentioned in my testimony, far and away it is a justifiable type approach.

Thank you.

Mr. WAXMAN. There are some people who have a misunderstanding about this bill who think that it would not require the polluter to pay. The polluter would still have to pay. Except, we would also have the costs of controlling acid rain shared by others as well.

I think this approach would be politically feasible for passage, and I think equitable overall. But we are going to look at these issues. These are issues that are sometimes complex, questions that clearly must be addressed. But what seems to me to be the most significant question is whether we are going to get going and move forward on acid rain control legislation.

I want to thank the members of this panel. Let me announce to those of you who are here and would like to have a statement in the record, please give your written statement to the subcommittee staff. We will make written statements part of the today's record.

The record from this hearing will be shared with our colleagues on the subcommittee, other members of the Congress, and the public, so that we will then have a compilation of evidence to serve as the basis for the consideration of various options in dealing with acid rain legislation.

Finally, let me thank Congressman Sikorski for inviting me here today and for your hospitality. It is a pleasure for me to be here. It is unusual for me to be in such a cold climate, but with these ear muffs I have no doubt that I can weather any storm that may come about.

All of you should be very proud of the work that Congressman Sikorski is doing to deal with the acid rain problem, and the work that Senator Durenberger is doing as well. Between the work of your two representatives on both sides of the capitol, and those of us who are sympathetic to what they are trying to do, I hope we can come up with some legislation, not years from now, but next year.

Thank you. That concludes the work of our subcommittee. The meeting stands adjourned.

[Whereupon, at 11:35 a.m. the hearing was adjourned.]

[The following statements and letters were received for the record:]

TESTIMONY OF
STATE REPRESENTATIVE WILLARD M. MUNGER
PRESENTED TO THE
U. S. HOUSE OF REPRESENTATIVES
HEALTH AND ENVIRONMENT SUBCOMMITTEE
FRIDAY, DECEMBER 9, 1983
ST. PAUL, MINNESOTA

My name is Willard Munger. I appear before you today as a state legislator representing Duluth, Minnesota, and as Chairman of the Minnesota House Committee on Environment and Natural Resources.

Minnesota's precious water and timber resources are clearly threatened by acid precipitation. The State Legislature has taken aggressive steps to do everything in our power to mitigate the problem. Other witnesses today will discuss in detail the regulatory program enacted in 1982. But that program deals only with emissions generated in Minnesota and we believe that over two-thirds (2/3) of the acid rain falling on Minnesota originates outside our jurisdiction. We urgently need Congressional assistance for both a national plan to control acid deposition and for international treaties to address the problem on a global basis.

I'd like to take this opportunity today to submit for the hearing record a copy of the Minnesota Legislature's Resolution No. 5, adopted during the 1983 Session, which formally requests Congressional assistance to control the sources of acid rain.

I would also like to assure the subcommittee that the Minnesota Legislature will continue to take whatever steps are necessary to address this problem at the state level.

STATE OF MINNESOTA

LEGISLATURE

Introduced by Representatives Munger; Rose; Nelson, D.;
Battaglia and Kahn

A resolution

memorializing the President and Congress of the United States to take immediate steps to curb the sources of acid rain.

WHEREAS, acid rain is becoming our number one environmental problem across the United States and Canada with a potential of destroying agricultural crops, forestry, aquatic life, and causing damage to structural buildings; and

WHEREAS, the long-range transport of atmospheric pollutants can cause acid rain far from emission source and is a growing interstate and international problem; and

WHEREAS, current provisions of the Clean Air Act are not adequate to address the problems of acid rain, and present and future generations will be more adversely affected by delayed action; and

WHEREAS, acid rain contributes to the increasing levels of heavy metal concentrations in public reservoirs and waterways which can pose a threat to human health; and

WHEREAS, acid rain has destroyed aquatic life in lakes, retarded certain forest and agricultural crop growth, and corroded metals and public buildings and statues; and

WHEREAS, in the Voyageurs National Park and Boundary Waters Canoe Area Wilderness, recent tests show high acidity in the lakes which scientists fear will cause serious damage to their whole ecosystems if the conditions remain unchecked; and

WHEREAS, the problem of acid rain is a serious threat to the tourism component of Minnesota's economy and the friendly relations with our neighbors in Canada; and

WHEREAS, Canada's Minister of the Environment identifies acid rain as "the single greatest irritant to the United States-Canadian relationship"; and

WHEREAS, Canada and the United States signed a 1980 Memorandum of Intent to combat transboundary air pollution; and

WHEREAS, Canada has already achieved cuts of 25 percent in sulfur emissions and a promise of 50 percent cuts by 1990 if the United States agrees to do the same; and

WHEREAS, the state of Minnesota has enacted a 1982 law designed to curb the sources of acid deposition within our state; and

WHEREAS, the Minnesota Pollution Control Agency has identified that significant areas of Minnesota may be damaged by the effects of acid precipitation; NOW, THEREFORE,

BE IT RESOLVED by the Legislature of the State of Minnesota that the President and Congress should take immediate action in this session of Congress to reduce the sources of acid rain by amendment to the Clean Air Act, or by separate legislation, and by providing adequate funding to the Environmental Protection Agency for monitoring and enforcement.

BE IT FURTHER RESOLVED that the Secretary of State of the State of Minnesota is instructed to transmit certified copies of this resolution to the President of the United States, the President and Secretary of the United States Senate, the Speaker and Chief Clerk of the House of Representatives of the United States, to the Minnesota Senators and Representatives in Congress, to the Premiers of Manitoba and Ontario and to the Ambassador of Canada to the United States.

H. F. No. 1059

Harry A. Sieben, Jr.
Speaker of the House of Representatives.

Jerome M. Hughes
Jerome M. Hughes
President of the Senate.

Passed the House of Representatives this 17th day of May in the year of Our Lord one thousand nine hundred and eighty-three.

Edward A Burdick
Edward A. Burdick
Chief Clerk, House of Representatives.

Passed the Senate this 19th day of May in the year of Our Lord one thousand nine hundred and eighty-three.

Patrick E. Flahaven
Patrick E. Flahaven
Secretary of the Senate.

Approved
6/1/83

Rudy Perpich
Rudy Perpich
Governor of the State of Minnesota.

Filed 6/1/83

Joan Anderson Growe
Joan Anderson Growe
Secretary of State.

STATEMENT OF MINNESOTA CHAPTER OF THE WILDLIFE SOCIETY

While no acidified waters or biological damage have been documented in Minnesota to date, portions of the state are presently receiving acidic deposition at or near levels believed to have caused biological damage in Sweden, Norway and northeastern North America. A large portion of this deposition, up to 80 percent. originates from sources outside our state boundaries. This means that, though we are leaders in state legislation addressing acid rain, federal and international assistance will be necessary to significantly reduce deposition rates.

Of primary concern to Minnesotans is potential damage from acid rain to our aquatic systems. The buffering capacity, or ability to neutralize acids, is very low in many lakes in north central and northeastern Minnesota, causing them to be susceptible to damage from acid deposition. Some 500 Minnesota fish lakes are classified as extremely or moderately susceptible according to a classification scheme developed by the Minnesota Pollution Control Agency. More detailed information on these lakes will be provided in a report by the Department of Natural Resources Fisheries Section due out next spring.

Included in the list of fish species most sensitive to acid rain are walleye, lake trout, rainbow trout, smallmouth bass and burbot, as well as some of the salmon which spawn in tributaries to Lake Superior. These tributaries, due to increased levels of acids and aluminum leached from the watersheds during periods of snowmelt or heavy rainfall, may be the most sensitive aquatic systems in Minnesota. Acidification can result in the inability of species to successfully reproduce, alter growth rates, increase metal contamination of fish flesh and change species composition. It is extremely important that we control rates of acid deposition at levels which will ensure environmental integrity.

SIGURD OLSON ENVIRONMENTAL INSTITUTE
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Testimony Before the U.S. House of Representatives
Health and Environment Committee, St. Paul, MN
December 9, 1983
by: Thomas J. Klein, Director
Sigurd Olson Environmental Institute
Ashland, Wisconsin 54806

I am Tom Klein, Director of the Sigurd Olson Environmental Institute, located in Ashland, Wisconsin. We are an environmental education division of Northland College, a private liberal arts institution.

I am here not to tell you about Scandinavian research or Camels Hump or limestone injection multistage burner systems. You will hear from people far more expert on those and many other technical issues.

I am here to give the committee a perspective on the regional story, the view from Lake Superior country. The area we travel - northeast Minnesota, northern Wisconsin and the Upper Peninsula of Michigan - is the area of the Midwest most sensitive to acidic deposition. At least 2,000 lakes in both northern Minnesota and Wisconsin are defined by EPA as highly sensitive. Nine lakes in the Upper Peninsula of Michigan have been defined as acid and a dozen lakes in northern Wisconsin have been identified by the Wisconsin Department of Natural Resources as possibly acidified. More research on these lakes is required but the evidence is compelling that the first stages of acidification are now visible. Our northern region will not escape the damage that has visited Scandinavia, Quebec or the Adirondacks. It will just take longer here. Our clock is running.

Last Thursday, at an acid rain seminar in Ironwood, Michigan, two Forest Service acid rain researchers from the U.S. Forest Service's North Central Experiment Station in Grand Rapids, Minnesota, predicted that if acid deposition continues at the current level, 5-7% of the lakes in northern Michigan and Wisconsin would be acidified. If the acidity of the deposition were to double (in wet deposition this is only a .3 pH change) 15-25% of the lakes in that region would acidify. I urge this committee staff to contact these researchers - Elon Very and Dale Nichols - to acquire the details of their methodology. Our northern lakes are for many counties the economic backbone. In Vilas County, Wisconsin, for example, sport fishing on inland lakes contributes thirty-five million dollars to the local economy. Water related recreationfor Minnesota, Wisconsin and Michigan is multi-billion dollar business. This is not obviously just an ethical and environmental issue. We need to fully protect the resources that both the tourism and forest product industries depend on.

People in the north are aware of this issue. In a poll we conducted one year ago, we sampled opinions in Lake Superior coastal cities. Sixty-five percent of those polled indicated they perceive acid rain as a serious problem. Another 15% viewed it as a minor problem. Improved protection against acid rain was seen as an important regional goal by 84% of the random sample respondents. As many other polls have indicated, people here are willing to pay the price for cleaner air. Eighty-one percent indicated they would be willing to spend up to 1% of their annual income (on a onetime basis) to fund the capital costs for a control program. Forty-four percent were willing to spend up to 5% of their annual income.

In the past two years we have conducted 80 seminars on this issue. I personally have been face-to-face with over 2,000 persons, answering their questions and hearing their concerns.

It has become apparent that people in the north are tired of waiting. In general, people are fearful of possible economic disaster if acidic deposition goes unchecked. People want action. They know the clock is running. I urge the committee to move this legislation along as quickly as possible.

COOPERATIVE
POWER
ASSOCIATION

December 8, 1983

The Honorable Gerry Sikorski
U.S. House of Representatives
414 Cannon House Office Building
Washington, DC 20515

Dear Congressman Sikorski:

Over the past several months, Bob Ambrose and I have had several meetings with you, your staff and subcommittee counsel Gerry Dodson regarding the impact of H.R. 3400 on Cooperative Power Association (CPA) member system consumers. I would like to take this opportunity to summarize what has been discussed and the conclusions we have reached.

However, before I get into those details, I feel that it is important for you to know that CPA has had a long-standing interest in acid rain and will continue to work hard to gain the best possible understanding of the issue in order to positively contribute to this important public policy debate. While you are aware of some of the efforts Bob and I have made, I would like to inform you of other significant efforts which have been or are being made by CPA. For example, Steve Lindenberg, CPA's supervisor of environmental compliance and monitoring, is chairman of the Mid-Continent Area Power Pool (MAPP) Acid Rain Technical Studies Group which is currently conducting studies assessing the impact of MAPP utility emissions. On behalf of the Minnesota/Wisconsin Power Suppliers Group (M/WPSG) -- a consortium of electric utilities serving Minnesota and western Wisconsin -- Steve was instrumental in the creation of the Technical Review Committee which is advising the Minnesota Pollution Control Agency (MPCA) during implementation of Minnesota's Acid Deposition Control Act. Steve also was project manager for the M/WPSG in a joint study with the Electric Power Research Institute designed to apply decision theory analysis in assessing the costs and benefits of acid rain controls in Minnesota. Steve is to become president of the Upper Midwest Section of the Air Pollution Control Association in 1984.

14615 Lone Oak Road, Eden Prairie, Minnesota 55344-2287 612/937-8599

Eric Bauman, CPA's supervisor of environmental planning, is currently chairman of the MAPP Acid Rain Task Force, which coordinates MAPP area utility activities on this issue. Among other things, this group was responsible for planning and conducting the recent acid rain conference in Bloomington at which Keith Krueger from your office was a featured speaker.

I serve as chairman of the M/WPSG Environmental Committee which established and funded the state's most comprehensive acid deposition monitoring program. Member utilities are particularly proud of this program, which was started in 1980 and has contributed significantly to what is known about acid rain in Minnesota. Data and analysis from this ongoing program, conducted by the University of Minnesota, have been made available to the MPCA.

Finally, Ted Lennick, CPA's general manager, has taken a personal interest in this issue. While serving as chairman of the Generation and Transmission Managers Association -- a national organization representing cooperative electric utilities like CPA -- Mr. Lennick met with U.S. Environmental Protection Agency Administrator William Ruckelshaus to discuss acid rain and possible policy options. Mr. Lennick remains an active member of the G&T Managers Association Acid Rain Task Force.

All of this is to say that CPA's views on acid rain are the product of a significant effort over the past several years and have been carefully considered.

At our meeting with you on September 15, Bob Ambrose and I outlined CPA's assessment of H.R. 3400 and the other acid rain control bills currently introduced in Congress. Our most serious concern was that H.R. 3400 appeared to require a scrubber retrofit at Genoa 3 — a 350 MW facility in Genoa, Wisconsin, shared by CPA and Dairyland Power Cooperative. According to the Congressional Research Service and the Office of Technology Assessment, the fund generated by H.R. 3400's one mill/kwh levy is not likely to provide reimbursement for capital investments beyond the 50 largest emitters. Since Genoa 3 is not one of the 50 largest emitters, CPA would be put in the position of helping to subsidize the clean-up of other "dirtier" utilities while having to pay its own very substantial clean-up cost.

As you know, CPA finds this to be very unfair, especially since CPA has already made a significant investment in SO_2 control, and has very low system-wide emissions.

In response to our concern, you expressed your belief that a scrubber at Genoa 3 may not be required and suggested that we review with your staff and subcommittee counsel Gerry Dodson, the reasoning that lead to our conclusions.

I met with Mr. Dodson and Keith Krueger on September 28, and provided a detailed analysis of how a 70 percent reduction in Wisconsin SO_2 emissions (as required in H.R. 3400) could be achieved. (See attachment.) Reviewing this analysis, Mr. Dodson suggested that reductions by sources other than utilities may substantially lessen the required SO_2 reduction by Genoa 3. I agreed to re-evaluate the Wisconsin control scenario in this light.

On November 18, I provided Mr. Krueger with the full Wisconsin emission inventory, including both utility and industrial sources. This again showed that a scrubber retrofit would be required at Genoa 3. I also informed Mr. Krueger that further analysis of H.R. 3400 indicated that Coal Creek Station, a facility located in North Dakota and jointly owned by CPA and United Power Association, would also be impacted by H.R. 3400. Even though Coal Creek Station currently emits SO_2 at a rate less than 1.2 lbs. SO_2/mmBtu, in order to meet new source performance standards under the Clean Air Act, we have concluded that H.R. 3400 would require a 50 percent increase in SO_2 removal. We doubt the existing control equipment at Coal Creek Station could handle that requirement.

Finally, also at that November 18 meeting, we discussed the adequacy of the fund to cover capital costs imposed by H.R. 3400. Mr. Krueger indicated that the one mill/kwh levy could be tied to inflation to assure that the fund would be adequate. Our reading of the CRS and OTA studies regarding the adequacy of the funds is not reassuring. For example, the sensitivity analysis run on the capital cost variable showed that it was the key variable in determining whether the one mill levy was sufficient to provide adequate funding for the desired level of capital investment.

Interestingly, the sensitivity analysis was based on a total investment of $12.6 billion ± 25 percent. In the analysis, when the cost of reductions exceeded $12.6 billion by 25 percent, the fund was not nearly adequate to cover reduction costs. Since various analyses show a very wide range in estimating the costs for a reduction of ten million tons of SO_2, we do not feel confident that even tying the one mill/kwh levy to inflation would guarantee adequate funding. For example, an OTA study estimated that a 2.5 mill/kwh levy would be necessary to raise the $40 billion contemplated in S. 2001. As you know, S. 2001 also seeks to reduce SO_2 emissions by ten million tons -- and theoretically it is expected to be able to do so more cost effectively. Our point is that a high degree of uncertainty in estimating the capital required to achieve a ten million ton reduction in SO_2 forces us to assume that no money will be available for the retrofit at Genoa 3.

Translating these SO_2 reduction requirements into dollars, CPA would be very severely impacted by H.R. 3400. We estimate that this legislation would cost CPA member system consumers $12 million annually and increase CPA annual revenue requirements by about ten percent. The annual cost to a typical residential consumer in our system would be nearly $52; for a typical farm, over $127 per year; for a typical dairy farm, almost $180 per year. This does not include the $30 million that our consumers will pay over 11 years to subsidize the clean-up of other utility system facilities.

As you can see, we have much to be concerned about with H.R. 3400. We realize that the intent of H.R. 3400 is cost-sharing in order to protect the economy and jobs in the economically stressed Midwest. In our case, the reality is an inequitable burden to southern and western Minnesota farmers who are also fighting for economic survival. We know that you share our concern for our member system consumers, and we look forward to working with you in efforts to lessen the burden that they would bear under H.R. 3400.

Sincerely,

Willi Kaul

William R. Kaul, Manager
ENVIRONMENTAL AFFAIRS DEPARTMENT

WRK/dkc

cc: Gerry Dodson

Table 1

EMISSIONS REDUCTIONS REQUIRED BY THE SIKORSKI/WAXMAN PROPOSAL

(Utility sulfur dioxide emissions/reductions,
in 1000 tons/yr, assuming all reductions
are achieved by utility sources only)

STATE	BASE EMIS.	INIT REDUC	REDUC AFT CR	FINAL EMIS.	PERCENT BELOW BASE	PERCENT BELOW TOTAL
Alabama	543.1	281.0	232.9	262.1	51.7	37.0
Arizona	87.5	0.0	0.0	87.5	0.0	0.0
Arkansas	26.5	0.6	0.0	17.0	35.8	9.4
California	77.9	0.0	0.0	77.9	0.0	0.0
Colorado	77.5	0.3	0.3	77.2	0.4	0.2
Connecticut	32.0	0.0	0.0	31.8	0.6	0.3
Delaware	52.5	16.6	0.0	29.0	44.7	21.4
District of Columbia	4.6	0.0	0.0	4.6	0.0	0.0
Florida	725.9	334.2	333.3	391.7	46.0	30.5
Georgia	736.7	453.7	453.7	283.0	61.6	54.0
Idaho	0.0	0.0	0.0	0.0	0.0	0.0
Illinois	1125.6	753.2	709.8	372.4	66.9	51.2
Indiana	1539.6	1172.0	1121.7	367.6	76.1	58.4
Iowa	231.3	125.8	125.8	105.5	54.4	38.3
Kansas	150.1	74.7	34.9	73.4	49.8	33.5
Kentucky	1007.5	708.4	410.4	299.2	70.3	63.2
Louisiana	24.8	0.0	0.0	24.8	0.0	0.0
Maine	16.3	2.7	2.7	13.6	16.4	2.8
Maryland	223.2	107.7	98.0	115.4	42.3	31.9
Massachusetts	275.6	104.3	47.6	171.3	37.8	30.3
Michigan	565.3	233.3	226.5	332.0	41.3	25.7
Minnesota	177.3	63.3	63.3	114.0	35.7	24.3
Mississippi	129.2	71.9	71.9	57.3	55.6	25.2
Missouri	1140.5	894.7	894.7	245.8	78.4	68.7
Montana	23.4	1.5	1.5	21.9	6.6	0.9
Nebraska	49.4	7.5	7.5	42.0	15.1	10.0
Nevada	39.5	0.0	0.0	39.5	0.0	0.0
New Hampshire	80.5	49.4	46.3	31.1	61.4	53.2
New Jersey	110.2	37.4	37.4	72.8	34.0	13.4
New Mexico	84.6	0.0	0.0	66.0	22.0	6.9
New York	480.3	222.1	214.4	258.2	46.2	23.5
North Carolina	435.4	86.8	86.8	348.6	19.9	14.4
North Dakota	82.5	11.6	11.6	70.8	14.1	10.9
Ohio	2171.6	1589.7	1409.4	581.9	73.2	60.1
Oklahoma	37.7	0.0	0.0	37.7	0.0	0.0
Oregon	3.3	0.0	0.0	3.3	0.0	0.0
Pennsylvania	1466.1	846.3	679.6	619.8	57.7	41.8
Rhode Island	5.2	0.0	0.0	5.2	0.0	0.0
South Carolina	213.1	94.2	94.2	118.6	44.2	28.9
South Dakota	28.5	8.9	8.9	19.7	31.2	22.7
Tennessee	933.7	666.1	309.0	267.5	71.3	61.9
Texas	302.7	11.7	11.7	291.1	3.9	0.9
Utah	22.1	0.0	0.0	22.1	0.0	0.0
Vermont	0.5	0.0	0.0	0.5	4.8	0.4
Virginia	163.7	25.9	21.8	137.7	15.8	7.2
Washington	69.3	21.6	0.0	42.1	39.2	10.0
West Virginia	944.2	571.4	571.4	372.9	60.5	32.5
Wisconsin	485.7	342.6	342.6	143.1	70.5	33.7
Wyoming	120.0	7.3	0.0	78.6	41.6	28.1
Regional Total	17324.5	10080.6	8681.8	7240.9	58.2	38.1

WISCONSIN UTILITY BOILER CONTROLS

Plant	Controls	SO_2 Reductions 1000 Tons
Oak Creek	90% Scrubber	108
Valley	90% Scrubber	37
Edge Water	90% Scrubber	53
Nelson Dewey	90% Scrubber	28
Columbia	Increase Controls	10
Rock River	Fuel Switching	3
Genoa	90% Scrubbers	41
Alma	Load to J.P. Madgett	9
Pulliam	90% Scrubber	42
Weston	Fuel Switching	6
Bay Front	Retired	3
		340

Approximate cost $100,000,000/yr.

County Summary of Wisconsin Sulfur Dioxide Emissions by Source Category*

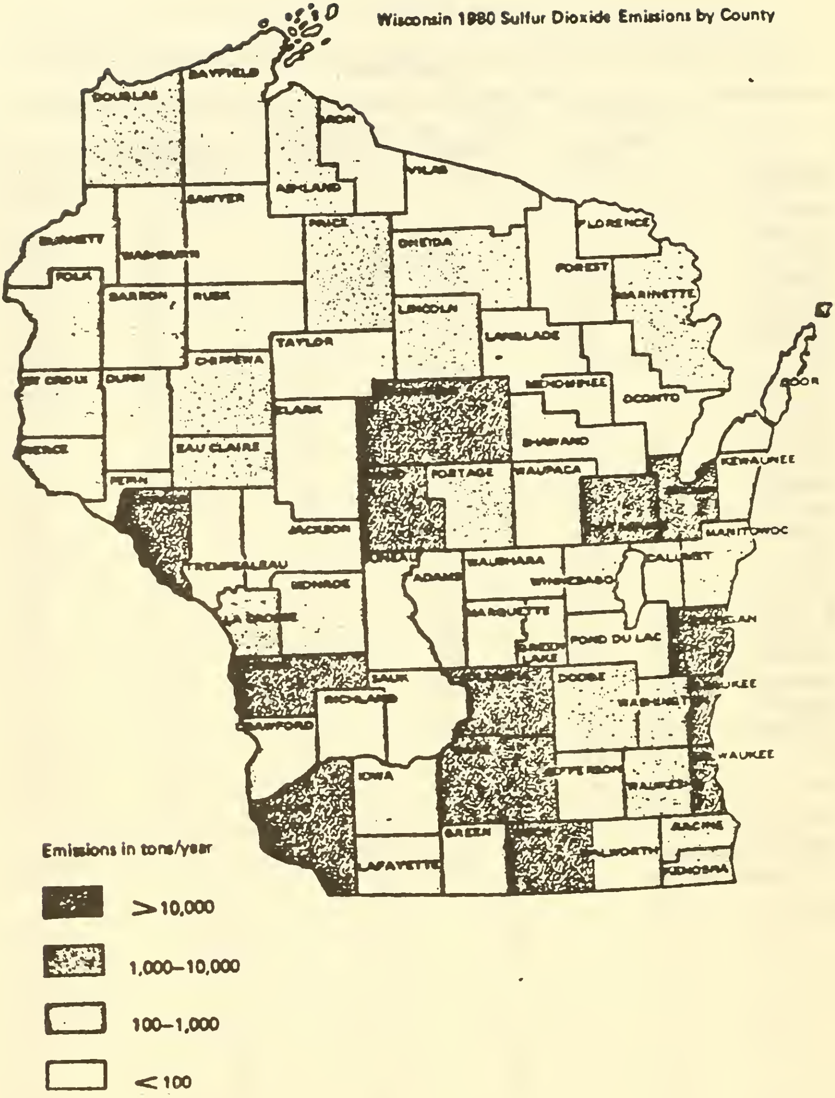
County	SO_2 Emissions (tons) Point Sources	Area Sources	Line Sources	Biogenic Sources	Total
Adams	5	43	13	59	120
Ashland	2,639	75	28	95	2,837
Barron	241	160	70	79	550
Bayfield	1	90	21	134	246
Brown	84,248	362	590	48	85,248
Buffalo	19,061	74	28	65	19,228
Burnett	17	50	20	77	164
Calumet	0	103	49	30	182
Chippewa	768	202	84	93	1,147
Clark	59	161	96	112	428
Columbia	34,768	165	105	71	35,109
Crawford	5	68	27	52	152
Dane	13,821	825	441	110	15,197
Dodge	906	258	108	82	1,354
Door	3	114	38	45	200
Douglas	3,321	151	65	120	3,657
Dunn	236	137	48	78	499
Eau Claire	1,806	257	128	59	2,250
Florence	7	19	6	45	77
Fond du Lac	35	272	180	67	554
Forest	29	27	28	92	176
Grant	32,097	212	90	105	32,504
Green	0	144	68	54	266
Green Lake	7	63	35	32	137
Iowa	24	96	41	70	231
Iron	0	55	13	69	137
Jackson	81	72	34	92	279
Jefferson	67	195	143	52	457
Juneau	0	74	50	71	195
Kenosha	21,607	1,049	225	25	22,906
Kewaunee	9	86	34	30	159
La Crosse	1,379	286	176	41	1,882
Lafayette	2	92	50	59	203
Langlade	12	79	44	79	214
Lincoln	5,177	93	40	82	5,392
Manitowoc	2,011	208	126	54	2,399
Marathon	31,186	300	204	146	31,836
Marinette	4,683	125	76	127	5,011
Marquette	0	38	24	42	104
Menominee	0	8	6	33	47
Milwaukee	162,703	5,989	1,200	22	169,914
Monroe	12	143	60	84	299
Oconto	98	97	60	92	347
Oneida	7,191	78	58	102	7,429
Outagamie	18,861	389	291	58	19,599
Ozaukee	40,775	612	95	22	41,504

County Summary of Wisconsin Sulfur Dioxide Emissions by Source Category*
Continued

County	SO$_2$ Emissions (tons) Point Sources	Area Sources	Line Sources	Biogenic Sources	Total
Pepin	0	34	16	22	72
Pierce	139	127	55	54	375
Polk	47	137	55	85	324
Portage	930	155	108	74	1,267
Price	1,207	68	36	116	1,427
Racine	36	1,493	194	31	1,754
Richland	633	77	23	54	787
Rock	17,294	339	183	66	17,882
Rusk	689	58	26	83	856
St. Croix	10	163	67	67	307
Sauk	136	182	123	77	518
Sawyer	12	49	19	116	196
Shawano	116	155	76	84	431
Sheboygan	57,773	259	156	46	58,234
Taylor	0	82	48	90	220
Trempealeau	18	123	57	67	265
Vernon	34,294	130	49	74	34,547
Vilas	21	65	32	80	198
Walworth	11	603	117	51	782
Washburn	2	59	28	75	164
Washington	102	908	168	39	1,217
Waukesha	77	2,160	453	51	2,741
Waupaca	12	158	85	69	324
Waushara	1	66	39	58	164
Winnebago	3,836	343	167	41	4,387
Wood	31,654	233	204	74	32,165
Total	639,008	22,422	8,000	5,000	674,430

*1981 emissions for major (1000 ton/year) point sources, 1980 emissions for all other sources.

1444C



Wisconsin 1980 Sulfur Dioxide Emissions by County

8. Emission Sources Inventory

Introduction

An inventory of sources of acid deposition precursors (primarily sulfur dioxide and nitrogen oxides) is being developed to identify and characterize sources that may contribute to acid deposition in Wisconsin and quantify their emissions. In January 1982 the DNR started to develop a comprehensive inventory including point, line, and area sources for Wisconsin, surrounding states, and southeastern Canadian Provinces. The inventory was designed to include both anthropogenic and natural sources of SO_2 and NO_x (base year 1980 and projections for 1990). The inventory should be completed by July, 1983.

Project Manager for this inventory is Paul Koziar, Bureau of Air Management, Wisconsin Department of Natural Resources. Technical review is provided by the Emission Sources Subcommittee of the Joint Acid Deposition Technical Review Committee with project responsibilities shown in Figure 8-1.

Project Description

The project began in January of 1982 and has been staffed by the Bureau of Air Management. Although the termination date was originally anticipated to be July 1984 it is anticipated that this project will be finished earlier.

Following is a discussion of work completed to date.

SURE Inventory - The Electric Power Research Institute has previously developed emission inventories of SO_2 and NO_x for the northeastern United States and southeastern Canada for the Sulfate Regional Experiment (SURE). The emissions on the SURE inventory are represented spatially on a rectangular grid with 80 x 80 km grid squares (Figure 8-2). The DNR has chosen to simply extend this grid for use in Wisconsin acid deposition studies (see Figure 13). The services of the U.W. Cartographic Lab have been retained to graphically construct the Wisconsin version of the SURE grid on a universal transverse mercator map projection. The emissions calculated for the SURE inventory were assumed to be correct after a cursory check of the data.

A detailed examination of sources of SO_2 and NO_x inside Wisconsin was made using 1980 as the base year.

Point Sources - Point sources were considered to be stationary sources whose emissions (SO_2 or NO_x) were greater than 10 tons/year. The Wisconsin DNR Air Emission Inventory (NR 101 file) was used as a basis for this inventory.

Line Sources - Emission factors were obtained from Compilation of Air Pollutant Emission Factors and were applied to state traffic data, which was supplied by the Wisconsin Department of Transportation, to determine SO_2 and NO_x emissions for Wisconsin. The emissions were allocated to counties in the same proportion as the National Emissions Data System (NEDS) 1980 line source inventory for Wisconsin. Emissions for the seven county southeastern corner of the state were computed by the Southeastern Wisconsin Regional Planning Commission.

Area Sources of Anthropogenic Emissions - Emissions from small industrial, commercial, residential, and other small miscellaneous sources of SO_2 and NO_x are considered to be area sources. Anthropogenic area source emissions for most counties were obtained from the National Emissions Data System Area Source Emissions Report for 1980. Emissions from the seven county southeastern corner of the state were computed by the Southeastern Wisconsin Regional Planning Commission.

Area Sources of Natural SO_2 - A literature search was conducted to determine if it was possible to inventory SO_2 from biological processes. It was found that the Electric Power Research Institute, as part of the SURE study, has estimated biogenic SO_2 emissions for all states east of the Mississippi River, including Wisconsin. The SURE emissions estimated for Wisconsin were allocated to counties by relative area.

Area Sources of Natural NO_x - Natural emissions of NO_x include decay of biological material, fertilizer application, animal urine and some agricultural practices. A literature search was conducted to determine if NO_x emissions from natural sources could be inventoried. From the outset of the literature search it was obvious that there would be difficulty in completing the inventory. Emission factors varied an order of magnitude for the same process. Emissions of NH_3 and N_2O complicate the inventory and are often not separated from NO_x emissions. More effort will be made to inventory natural sources of NO_x.

An examination of sources outside of Wisconsin was also made using 1980 as the base year.

U.S. Point Sources - The SURE inventory was relied upon to supply information on sources east of the Mississippi River. Point source data were obtained individually from the states of Texas, Arkansas, Oklahoma, Kansas, Nebraska, Missouri, Iowa, North Dakota, SOuth Dakota, and Minnesota. Emissions were allocated to appropriate grids.

Canadian Point Sources - Information on Canadian sources was obtained from Environment Canada and the provinces of Manitoba, Quebec and Ontario. Emissions will be allocated to appropriate grids.

U.S. Line and Area Sources - The SURE inventory was relied upon to supply data on area and line source emissions for states east of the Mississippi River. For states west of the Mississippi, area and line source data were obtained from the National Emissions Data System Inventory.

Canadian Line and Area Sources - A gridded emissions inventory from Environment Canada was used to compile Canadian line and area source emissions.

Natural Sources - The Environment Canada and NEDS inventories do not include natural sources that must be inventoried separately.

SO_2 - U.S. natural sources of SO_2 were inventoried similarly to Wisconsin natural sources. Canadian sources are yet to be inventoried.

NO_x - Natural sources of NO_x have not been inventoried because of the previously mentioned problems.

Preliminary Findings

For sources inside Wisconsin, the following conclusions have been made.

1) Point sources of sulfur dioxide have been categorized. Tables 8-1, 8-2, and 8-3 and Figures 8-3 and 8-4 illustrate some of the results. Generation of electric power is the most significant source of SO_2 in the state. Pulp and paper mills are the next most important source. Only 13 sources represent 80% of the total SO_2 emissions in Wisconsin in 1980.

2) Line sources represent only about 1% of the total emissions of SO_2 in the state.

3) Area sources, both natural and anthropogenic, represent a very small fraction (0.7%) of the total SO_2 emissions in Wisconsin. Some particular sources such as bacterial decomposition of asphalt and sulfur dioxide emitted from paving were investigated in some detail and were determined to be negligible as sources of SO_2.

4) Point sources for nitrogen oxides have been categorized. Tables 8-1, 8-4, and 8-5 and Figures 8-5 and 8-6 illustrate some of the results. Generation of electric power was the most significant source category of NO_x emissions. Pulp and paper production was again second. Only 24 sources of NO_x represent 88% of the point source emissions in the state.

5) Line sources proved to be a significant contributor to the total NO emissions in the state (40-50% of anthropogenic emissions).

6) Area sources of NO_x are only a minor contributor to the total anthropogenic emission in the state.

7) Natural sources of NO_x proved to be extremely difficult to inventory and will continue to be investigated as best possible in order to estimate NO_x emissions in the state.

For sources outside of Wisconsin a detailed categorization of emission sources has not been completed. However, certain generalities, such as the insignificance of natural sources of SO_2, may be extrapolated to other areas in the United States and Canada. Line sources of NO_x are certainly significant especially in highly populated areas

Wisconsin 1980 Point Source SO_x and NO_x Emissions by Source Size Category

SO_x

Source Size Category (tons/yr)	Number of Sources	%	SO_x Emissions (tons/yr)	%
> 10,000	13	2.4	549,594	79.6
1000-10,000	30	5.6	121,883	17.6
100-1000	40	7.5	16,309	2.4
10-100	76	14.3	2,390	0.3
0.1-10	374	70.2	727	0.1
Total	533	100.0	690,903	100.0

NO_x

Source Size Category (tons/yr)	Number of Sources	%	NO_x Emissions (tons/yr)	%
>10,000	5	0.6	103,685	51.8
1000-10,000	19	2.3	73,150	36.5
100-1000	62	7.6	15,832	7.9
10-100	201	24.6	6,136	3.1
0.1-10	531	64.9	1,528	0.7
Total	818	100.0	200,331	100.0

Table

Wisconsin 1980 Point Source SO_x Emissions By Source Category and Fuel Type
(includes only the 43 sources which emitted over 1000 tons)

Emission Source	1980 SO_x Emissions(tons)				Percent of Total 1980 Point Source SO_x Emissions (690,903 tons)
	Electric Utility Generating Stations	Paper Mills	Others	Total	
Coal	533,976	80,501	7937	622,414	90.1
Pulping Liquor	0	19,484	0	19,484	2.8
Residual Oil	33	5566	326	5925	0.9
Wood	57	427	0	484	-
Distillate Oil	121	6	1	128	-
Refinery Gas	0	0	61	61	-
Total Boiler Emissions	534,187	105,984	8325	648,496	93.9
Process Emissions	0	21,719	1259	22,978	3.3
Total Emissions	534,187	127,703	9584	671,474	97.2
Percent of Total 1980 Point Source SO_x Emissions	77.3	18.5	1.4	97.2	-

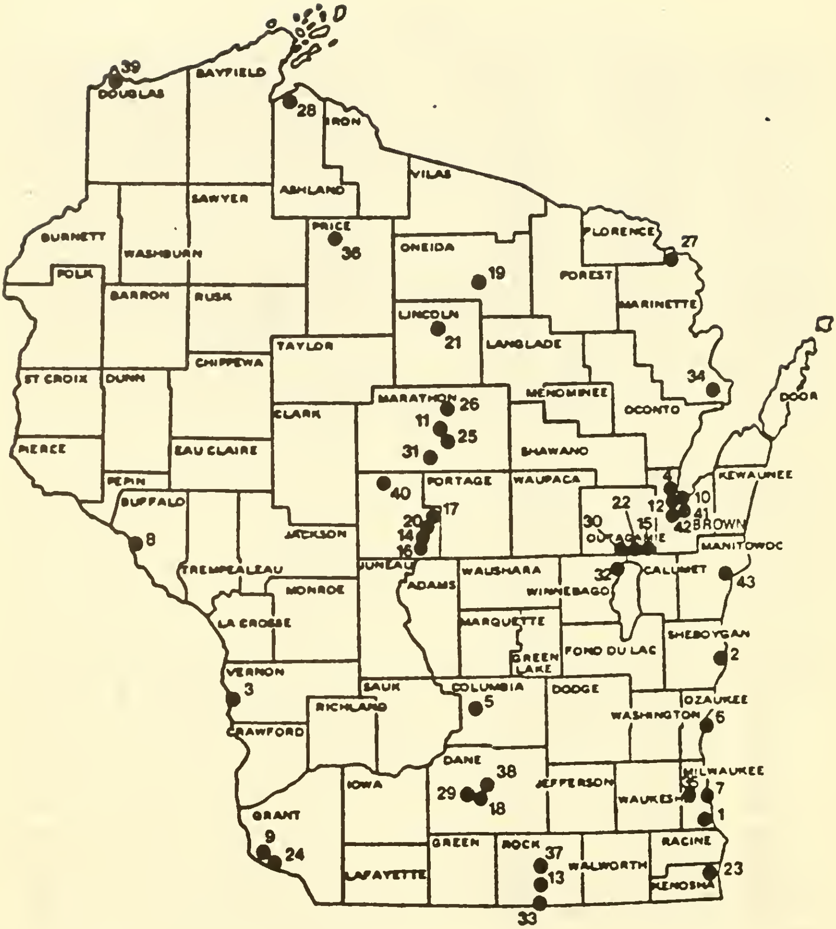
FACILITY	LOCATION	SO_2 EMISSIONS (tons/year)		
		1979	1980	1981*
Nicolet Paper	DePere	1542	1306	1072
Manitowoc Public Utility	Manitowoc	1093	1302	1505
Menasha Electric	Menasha	1122	965	1117
Colt Industries	Beloit	1124	671	1084
TOTAL		623301	673110	621283

*Emissions of SO_2 in 1981 were calculated with different emission factors then the previous two years. Sulfur dioxide emission factors for coal combustion increased 2.6% resulting in apparently higher emissions for combustion of coal with the same heating value and sulfur content.

Wisconsin Point Sources Which Emitted Over 1000 Tons Of Sulfur Oxides In 1980

Rank	Facility ID NO.	Facility Name	Facility Location	1980 SO_x Emissions (Tons)*				
				1	2	3	4	Annual
1	410034	WEPCo Oak Creek	Oak Creek	26,355	26,755	27,474	39,156	119,740
2	600003	WPSL Edgewater	Sheboygan	18,127	11,835	15,788	12,823	58,274
3	630003	Dairyland Power	Genoa	16,930	14,535	14,375	10,[illegible]	56,371
4	50013	WPSC Pulliam	Green Bay	13,747	11,715	10,541	9,522	45,525
5	110007	WPSL Columbia	Portage	9,311	10,296	11,305	10,447	41,359
6	430016	WEPCo Port Washington	Port Washington	12,363	10,3[illegible]	9,470	9,0[illegible]	41,2[illegible]
7	410132	WEPCo Valley Plant	Milwaukee	11,[illegible]	9,355	11,392	9,135	40,631
8	60001	Dairyland Power	Alma	6,493	5,483	10,572	10,578	34,122
9	270001	WPSL Nelson Dewey	Cassville	10,072	7,869	5,665	7,869	31,475
10	50003	Proctor & Gamble Fox River Mill	Green Bay	6,008	6,008	6,008	6,008	24,032
11	370003	WPSC Weston Plant	Weston	6,552	6,101	4,972	4,972	22,597
12	50008	Fort Howard Paper Co.	Green Bay	4,477	4,477	4,477	4,477	17,908
13	540003	WPSL Rock River	Beloit/Janesville	6,140	2,834	2,878	4,093	15,[illegible]
14	720011	Nekoosa Papers, Inc.	Port Edwards	2,393	2,393	2,393	2,393	9,572
15	450011	Thilmany Pulp & Paper	Kaukauna	2,183	2,184	2,183	2,183	8,733
16	720012	Nekoosa Papers, Inc.	Nekoosa	2,178	2,179	2,179	2,179	8,715
17	720009	Consolidated Papers, Inc.	Biron	2,143	2,143	2,143	2,143	8,572
18	130011	Madison Gas & Electric	Madison	2,945	1,80[illegible]	2,045	1,391	8,18[illegible]
19	430001	Rhinelander Paper Co.	Rhinelander	1,653	1,6[illegible]	1,5[illegible]	1,664	6,55[illegible]
20	720010	Consolidated Papers Kraft Div.	Wisc. Rapids	1,662	1,661	1,6[illegible]	1,551	6,545
21	350004	Owens-Illinois Forest Prod. Division	Tomahawk	1,385	1,500	1,384	1,500	5,769
22	450005	Midtec Paper Corp.	Kimberly	1,073	1,073	1,3[illegible]	1,277	5,363
23	300003	WEPCo Pleasant Prairie	Kenosha	0	0	2,279	3,078	5,357
24	270002	Dairyland Power Stoneman Sta.	Cassville	2,700	778	208	1,506	5,192
25	370055	Weyerhaeuser Company	Rothschild	1,263	1,170	1,123	1,123	4,679
26	370004	Wausau Paper Mills	Brokaw	905	904	905	904	3,618
27	380006	Niagara of Wisc. Paper Co.	Niagara	868	862	869	853	3,472
28	20004	Bay Front Generating Sta	Ashland	806	687	717	772	2,982
29	130029	UW-Madison	Madison	800	595	559	746	2,700
30	450004	Consolidated Papers, Inc.	Appleton	663	663	662	663	2,651
31	370009	Mosinee Paper Company	Mosinee	661	661	661	661	2,644
32	710006	Menasha Corp. Paperboard Mill	Menasha	591	552	591	552	2,286
	0012	WP&L Blackhawk Station	Beloit	860	156	645	294	1,955
	0002	Badger Paper Mills, Inc.	Peshtigo	468	468	485	452	1,873
	10054	Milwaukee Co. Institutions	Wauwatosa	492	401	455	474	1,822
	510001	Flambeau Paper Corp.	Park Falls	479	479	373	444	1,775
	540004	General Motors Assembly Division	Janesville	402	490	385	472	1,749
	130012	Oscar Mayer & Co.	Madison	402	402	453	420	1,677
	160012	Murphy Oil Corp.	Superior	412	411	412	411	1,646
	720001	Marshfield Electric	Marshfield	434	338	402	434	1,608
	50010	Green Bay Packaging	Green Bay	349	349	349	349	1,396
	50011	Nicolet Paper Co.	DePere	326	327	326	327	1,306
43	360006	Manitowoc Public Utilities	Manitowoc	325	326	325	326	1,302
		Total		179,950	156,465	159,730	175,329	671,474

*Quarterly and annual r[illegible]tions



Location of Point Sources in Wisconsin Which Emitted Over 1,000 Tons of Sulfur Dioxide in 1980

National Audubon Society
NORTH MIDWEST REGIONAL OFFICE
SUITE 920, LUMBER EXCHANGE BUILDING
10 SOUTH FIFTH STREET, MINNEAPOLIS, MN 55401 (612) 375-9140

TESTIMONY

ON

HR 3400

(As an addition to the
hearing held in St. Paul, Minnesota
on December 9, 1983)

Carol M. Beim
Regional Representative
National Audubon Society

January 26, 1984

Iowa • Minnesota • North Dakota • South Dakota • Wisconsin
AMERICANS COMMITTED TO CONSERVATION

The National Audubon Society is concerned about acid rain. The North Midwest Region of Audubon, consisting of members and natural resources in Iowa, Minnesota, North and South Dakota and Wisconsin, most definitely wants action taken now to control the acid rain problem.

Members in the Minneapolis/St. Paul area were pleased that they were provided with an opportunity to express their views on the acid rain control provided by H.R. 3400. At the hearing, the Sierra Club testified for several Minnesota environmental groups. Since the National Audubon Society has views slightly different from that testimony, ours is presented here.

H.R. 3400 is a bill which, when passed, will take a giant step forward in the control of acid rain. The 10 year reduction period is an achievable goal, and one which will deal with the problem as quickly as possible.

The 10 million reduction of sulfur dioxide is not as great as we would like or feel is achievable. The National Academy of Sciences announced in June of 1983 that a 50% reduction in sulfur dioxide is necessary to protect acid sensitive resources. The 50% reduction is equivalent to a 12 million ton reduction, which accounts for projectd new growth in sulfur dioxide emissions. Since projections for North Dakota indicate that future sulfur dioxide emissions will dramatically increase over the next 20 years, and could contribute to Minnesota's acid rain problem, we ask that the tonnage requirement for sulfur dioxide reduction be increased to 12 million in H.R. 3400. While nitrous oxide reductions are good additions to the bill, we feel sulfur dioxide reductions are crucial to control the problem.

The financing plan we feel is a political decision. Utilities in Minnesota have already substantially reduced their emissions, yet a nationwide tax would highlight the national problem and need for control of acid rain.

We support control of the acid rain problem, especially since sensitive resources in northern Minnesota and northern Wisconsin are at risk. We urge you to increase the sulfur dioxide reduction in H.R. 3400, which will better control the problem nationwide, while requiring citizens nationwide to help share the cost of cleanup. We can no longer wait to take action to handle the acid rain problem.

4436-18th Ave. South
Minneapolis, Minnesota
January 17, 1984

Congressman Henry Waxman, Chair
U.S. House of Representatives
Subcommittee on Health and Environment
2418 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Waxman:

On December 9, 1983, the U.S. House of Representatives Health and Environment Subcommittee held a public hearing at the Minnesota Capital in St. Paul on your HR 3400, the Waxman-Sikorski Federal Acid Rain Control Bill. Most regretably I was not able to attend this public hearing, but I would like to request that this letter be made part of the hearing record, and more importantly, that you press for immediate action on this bill.

Others have told you, I am sure, that Minnesota has precious resources at stake. About one-fifth of our state's surface area, and about 2,500 of our northern lakes are now considered to be sensitive to acid rain. Thirty-five per cent of Minnesota's forests and significant tourism areas are located in this central and northern part of the state. I have been told that a 12 million ton per year reduction in sulfur dioxide emissions is needed to curb Minnesota's acid rain problem or the growing threat of it. And also that a 48 state control program is necessary to decrease the acid rain problem here. Current EPA proposals are totally inadequate. And so on. Surely many others have told you and Congressman Sikorski these dismal facts.

I should like to ask if you know, as you probably do, that Captain Jacques-Yves Cousteau took his famous little ship the "Calypso" on a trip up the Mississippi River from the Gulf of Mexico to St. Paul and Minneapolis this past summer? I am a member of the word-wide "Cousteau Society", and I would like to quote to you part of a letter which I wrote to this Society in mid-December. My object was to try to enlist Captain Cousteau's aid inhelping to get something done in the U.S. Congress about the acid rain problem both in Minnesota and nationwide. It is my understanding that this famous and greatly respected man appears before Congress or some of its committees to advise them, or to warn them, about ecological problems and other problems which he sees at first hand on some of his expeditions.

(To The Cousteau Society. December 15, 1983.)

Did Captain Cousteau and his crew, in their exploration of the Mississippi River, get as far as the actual source of the river, or did they stop when they reached Minneapolis and St. Paul? I wish that they had gone on to the source (if they did not). The great river begins its flow out of Lake Itasca in northern Minnesota, a place I have visited often. Minnesota maintains its largest State Park there at the Mississippi Headwaters. In Itasca State Park there are a few acres of land which still look the way all of northern Minnesota once did. Virgin White and Red (Norway) Pine still grow there in some abundance. The infant Mississippi River chose a beautiful spot in which to begin its existence. If Captain Cousteau and his crew did not go that far north, they are in company with Mark Twain and Henry David Thoreau, both of whom came to Minnesota in search of the Mississippi during the 1800's but got no further than the Twin Cities. I feel privileged that I know just how the ambitious little stream looks which becomes, much further on, the greatest river of our continent.

Do Captain Cousteau and his fellow scientists know that the Mississippi River may be threatened by acid rain in the near future? It is possible because many of our northern lakes and small rivers or streams function as water-carriers to the Mississippi at its very start. While still a small stream itself, the great river flows through several lakes in northern Minnesota before emerging finally to flow straight south. Among these lakes, as I recall, are Lake Bemidji and Lake Winnebigoshish. Gull Lake near Brainerd, a lake I know well, is one of the lakes of good size which sends water into the Mississippi. Water flows from spring-fed Gull Lake into the Gull and Crow Wing Rivers. The latter small river empties into the Mississippi near Brainerd, about 145 miles north of Minneapolis and St. Paul. All of the aformentioned lakes are now endangered by being sensitive or potentially sensitive to acid rain.

Geologically the place now called "Minnesota" is very ancient. Most of Minnesota's northern lakes were formed by a retreating glacier some 8,000-10,000 years ago. Gull Lake, forinstance, remained clean and pure for probably thousands of years, but now this once lovely lake may soon be incompany with other northern lakes and small streams which are or will soon be carrying acid rain into the Mississippi River if something isn't done by the lawmakers in this country very soon. Consider: Water from Gull Lake and other lakes and streams in Minnesota, all of which function as tributaries to the Mississippi in one way or another,- this water can conceivably reach the Gulf of Mexico! And if some or all of these northern tributaries are tainted and then "killed" by acid rain, what will happen to the water supply of the Mississippi? Will people for the 2,552 miles of the Mississippi's length be drinking acid rain? !

If Captain Cousteau and his fellow scientists do not happen to know about this unfortunate situation, will you tell them? Maybe Captain Cousteau can say something to the U.S. Congress about the danger of acid rain in Minnesota and the danger to the Mississippi River just as the infant and young River gets its start. It is well known that Captain Cousteau undertakes to alert and educate decision-makers in our national government. (End of letter to The Cousteau Society.)

Congressman Waxman,- how about enlisting the help of Captain Jacques-Yves Cousteau in your upcoming fight to get your HR 3400 bill passed? In environmental matters this great man is a champion for us all.

Sincerely,
Edna L. Cunningham
Edna L. Cunningham

ACID RAIN CONTROL

FRIDAY, FEBRUARY 10, 1984

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Health and the Environment,
Indianapolis, Ind.

The subcommittee met, pursuant to call, at 9 a.m., in the board room, Indianapolis Public School Education Center, Hon. Henry A. Waxman (chairman) presiding.

Mr. Waxman. The subcommittee will please come to order.

I'd like to welcome you to this hearing of the Health and Environment Subcommittee of the Energy and Commerce Committee of the House of Representatives.

Before we begin today's field hearing, our subcommittee's third on the question of acid rain, I want to thank Congressman Phil Sharp for requesting this meeting, and for his valued counsel on its development. And I want to express my appreciation to Congressman Dan Coats, another member of the Commerce Committee, for his help and cooperation.

Acid rain is a severe and difficult problem. We know it is severe because our Nation's most distinguished scientists, including two panels from the National Academy of Sciences, and a panel handpicked by the Reagan administration, agree that sulfur dioxide emissions must be cut immediately.

They have found rainfall as acidic as vinegar falling in Indiana, and virtually every other State, and have concluded that it is destroying our most valued natural resources. Even worse, scientists now suspect acid rain directly threatens health by adding poisonous metals to drinking water supplies. Some studies even suggest that acid rain may be linked to Alzheimer's disease, a form of dementia caused by the degeneration of brain cells.

It is a difficult problem because, while the effects are well documented, and the means to control acid rain are readily available, there can also be costs in human and economic terms. When Representative Sikorski and I set out to draft our acid rain bill in 1983, we began with a fundamental question: Does the price for saving our lakes, forests, and health have to be unemployed coal miners or soaring electric rates?

We've answered no, and set out to meet a formidable challenge. We tried to craft a bill that provides strong environmental and health protections against acid rain while protecting midwestern workers and consumers.

Other acid rain control bills, with the exception of Senator Glenn's recently introduced Senate legislation, do not strike this balance. They require significant emission reductions, but do not provide for any cost-sharing mechanism. Many utilities claim that this would result in higher electric rates in any event, since, in order to preserve jobs, they would not switch to low-sulfur coal, but would install expensive control technology.

The United Mine Workers take a different view. Noting that these bills allow utilities to choose the most cost-effective reduction method, the UMW argues that acid rain legislation would result in widespread fuel switching and massive job losses. And they have a good reason for worry—even without acid rain legislation, utilities are now switching to low-sulfur coal to obtain emission reductions. If no legislation is passed, utilities will continue to switch, and the tragic story of unemployed mine workers will continue.

Perhaps one measure of our bill's success in balancing environmental and economic concerns is that over 120 Members of the House of Representatives, from both parties, and from all regions of the country, have cosponsored H.R. 3400. Another measure and one that is perhaps more important for Indiana, is that the western low-sulfur coal industry has harshly criticized the bill for emphasizing the use of high-sulfur coal and saving midwestern jobs. They have told us that the free market will take good care of Indiana's coal workers and their families. Jobs and new opportunities will be available in the west.

Their argument has not swayed us. People from Indiana, Ohio, and other midwestern areas have roots here. Acid rain legislation should not bring about massive regional dislocations. There is no reason or need to do so.

We know all of our witnesses today share all of these concerns. Indiana has much at stake, because it is one of the largest emitters of sulfur dioxide and has a coal industry built primarily around high-sulfur coal, large reductions will be demanded, and the State must insure that they are attained through technological controls, not fuel switching. Since controls can be expensive, we must also insure that a national cost-sharing mechanism is adopted.

The charts behind us clearly show this is possible. Because H.R. 3400's national cost-sharing mechanism will send more than $2 billion into Indiana, residential consumers will face only a 5 to 6 percent increase in their electric bills.

The charts also show that by forcing utilities to install technological controls, the bill will not just stabilize, but could expand Indiana's coal base. According to the most detailed analysis done to date, Indiana's coal production would rise from 31 million tons in 1980 to 40 million tons in 1995 if H.R. 3400 is adopted. For Indiana's miners, this means that H.R. 3400 would actually create 6,000 more jobs over the status quo. When indirect job gains are considered, the increase grows to 20,000 new jobs.

There are, however, some interested parties in the acid rain debate who do not want these facts and numbers publicized. Utilities, for instance, have used misinformation and scare tactics in opposing H.R. 3400. The reason is simple. The utilities would rather switch to low-sulfur coal from the west than install scrubbers which enable, them to continue using Indiana and other midwestern coal. While it is convenient for the utilities to switch, it is very damaging for Indiana's coal miners. They, and their families, are the victims of coal switching.

We can meet the acid rain challenge and actually bring new economic growth to the Midwest and environmental and health gains to all regions of our Nation. We are holding this hearing to share these findings with you, and as well to gain the benefit of your views. I urge you to look closely at the information prepared by independent analysts, such as the Congressional Office of Technology Assessment and ICF, that do not have a self-interest in this matter.

They are telling us that H.R. 3400 will start putting people back to work, not take them out of the mines. If they are right, I can think of no better reason for Indiana to support acid rain controls.

I look forward to hearing from our witnesses today, and when we begin markup on H.R. 3400 in the very near future, working with you in fighting for acid rain legislation that helps, not hurts, Indiana.

I wanted to set forth, in this rather lengthy statement, why we think this bill is a good one, and why we're here today to share this information with you, and to learn how you evaluate the problem.

Before calling upon some of our witnesses, I want to recognize our colleagues. First of all, I recognize Congressman Sharp for any welcoming comments he might wish to make.

STATEMENT OF HON. PHILIP R. SHARP

Mr. SHARP. Thank you very much, Chairman Waxman. I particularly want to thank you for bringing the subcommittee to Indiana, and for Congressman Sikorski, a cosponsor of the bill and a member of the subcommittee, for coming today.

As you have already indicated, this question is of profound importance to us in Indiana. We have to recognize that we are the second largest emitter of sulfur dioxide in the country. Any proposal dealing with acid rain is clearly going to have an impact on us.

And I am delighted that in developing a proposal, you have recognized this and begun to call for a program of national cost-sharing.

I have not yet indicated how I will come out on your legislation. I intend to hear from the people here today, and others that will be discussing the issue with me in trying to assess the statistical information that people are looking at as to the cost of this bill.

But I think that we, in Indiana, cannot be ostriches, we cannot bury our heads in the sand, and pretend like there is not a problem, and there won't be any solution. If we take that approach, I think we simply will be dealt out of the issue in the U.S. Congress. I'm convinced that, at some point, whether it's this year, or next year, or 2 years from now, the U.S. Congress is going to act on this matter. And I think we, in Indiana, ought to understand those realities, and understand them very clearly, and begin to prepare ourselves to deal with that.

And so I am delighted that you are here to hear from our people, who are very concerned about this. And I want to thank you.

Mr. WAXMAN. Thank you very much.

Let me indicate the high regard that the members of our committee have for both Mr. Coats and Mr. Sharp. When both of them suggested we come here and hear from the people in Indiana, we did not hesitate at all, because we feel it is important that we come and work with you as we try to craft legislation that deals in a sensitive way with the economic problems that we see in the Midwest.

I would like to call on Mr. Coats for any comments he wishes to make at this point.

STATEMENT OF HON. DAN COATS

Mr. Coats. Thank you, Mr. Chairman. I also commend you for holding these hearings in Indianapolis and hearing from the people of Indiana as to what the potential effects of acid rain might be on our State. I am pleased that this is one of three hearings scheduled for the midwestern region of the country, where the brunt of any acid rain proposals will be felt.

I also want to join in welcoming Governor Orr and the witnesses that will be testifying today before the panel.

Rarely has an issue come before Congress which has been as decisive, and as poorly understood, and is as controversial as the subject of acid rain. It has divided the scientific community. It has pitted regions of the country against each other, and caused major disagreements within political parties.

We do have lakes in northeastern Indiana, and other parts of the United States, which are acidified, and we should do something about it, but there clearly does not now exist sufficiently convincing scientific or economic data which justifies charging off blindly into a multibillion-dollar control program with all of its adverse social and economic consequences.

It is imperative that we realize that acid rain control is not merely an environmental issue. It is also a labor issue, and also a consumer issue. We're going to hear some testimony later today from the United Mine Workers as to the potential impact of acid rain legislation on employment in the mine industry. It is also a labor issue from the standpoint that in this area of the Midwest—and I think it's important that we recognize this—which is now beginning to climb out of a recession, a recession caused partly by economic problems, and partly by a transition in the way this country does its business. We are just climbing out of that, we are doing well, and are on the way up, but we have come through some very, very difficult times. We have lost plants to the Sun Belt; one of the primary reasons being lower energy costs.

We need to do all that we possibly can to insure that future viability of the State of Indiana by maintaining relatively low-cost energy availability for industries and for the consumers that work in those industries. That is critical to the growth and development of Indiana in the future, and this legislation could have serious adverse consequences for that growth and development.

It's also a consumer issue from the standpoint that it affects residents of Indiana in terms of the costs that they will pay for their electric bills. Those fees—we have various estimates as to what those increases of fees will be in the Waxman-Sikorski bill, or the bill in the Senate, or other proposals enacted. Estimates vary, and so figures that are proposed range anywhere from 50 cents all the way up to $20 and $25 per month on energy bills. We need to find out for sure just what those extra costs would be.

I note that the Urban League, which will not be testifying before us, but has submitted testimony to this committee indicates, and I quote:

> That individuals in Indianapolis, who utilize state and Federally funded programs, will find themselves in a serious financial situation if their electric bills are increased substantially by acid rain legislation. While the acid rain funds is proportioned to pay for additional environmental controls equipment, we are not naive enough to believe that the tax and utility companies increases won't be passed on to the consumer. Before you ask Indianapolis's unemployed and poor to help foot the bill, you must be absolutely sure that it is a problem and not just speculation. The Indianapolis Urban League wants a clean environment. It supports additional research to answer the questions concerning the acid rain that are still unanswered, because we must have the answers to develop rational public policy.

This is an additional concern which, I think, all of us have to be sensitive to, that is, the impact of increased electric bills on the poor and on the elderly. The Urban League speaks to this, and I am pleased that they were able to submit testimony before us, but since they weren't able to verbally testify, I'm pleased to be able to insert part of that statement in the record of my remarks.

On January 25 of this year, the state of the Union address, President Reagan laid out a course that I and many other members of the Energy and Commerce Committee had been urging for 3 years.

First, accelerate research into the phenomenon of acid rain so that we really know that additional moneys spent on emmission controls will result in some environmental benefit.

Second, begin a Federal mitigation program at the affected areas, including lake liming and fishery stocking. We can improve these lakes that are acidified at a very reasonable cost.

And, third, encourage the development of new technologies to control sulfur dioxide and nitrogen oxide emissions from stationary sources in an efficient cost-effective manner.

I'm just summarizing my statement here, Mr. Chairman, in order to save time so we can get to the witnesses, but just a couple of more comments.

In terms of development of new technology, a number of things are now taking place that hold great future for Indiana, and I think we need to be sensitive to these. If we enact quickly an acid control bill that deals only with the scrubber solution to the problem, I think we may be overlooking new technologies that can better deal with the problem at a much reduced cost. A number of new technologies are emerging. These include select gas use, which is the combination of burning natural gas with high-sulfur coal in either the same or separate combustion units; furnace limestone injection; the feeding of dry, pulverized limestone into the furnace where it reacts with SO_2 to form gypsum; fluidized bed combustion; and, something that now is underway in terms of the pilot project in Indiana, the E-beam technologies. These technologies can provide us significant steps forward in dealing with the problem.

In addition, we have to be mindful of the fact that the Clean Air Act is requiring substantial reductions in sulfur dioxide emissions. And the question has to be raised as to whether or not this multibillion-dollar program that the H.R. 3400 calls for, and its intended consequences on Indiana consumers and users of electricity, is going to result in any different result in the year 2000, or beyond, than we would have achieved through present law, which requires a mandating of reduction in sulfur dioxide.

In summary, Mr. Chairman, I, again, commend you for holding hearings on this important issue. Only by having these hearings and hearing the testimony of the affected people can we gather all the facts that are necessary to deal with this question.

I want to, again, remind the committee and remind my colleagues in Congress that it is more than an environmental issue that we're dealing with. We're dealing with a consumer issue, a labor issue; an issue that affects midwesterners in a very, very direct way.

I, at this time, would like to submit the testimony of a colleague in the Senate, Senator Quayle, who was not able to be here today because of Senate business, but has a statement, and I ask unanimous consent that it be included in the record.

[Mr. Coats' prepared statement follows:]

OPENING STATEMENT OF THE HONORABLE DAN COATS BEFORE THE SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT COMMITTEE ON ENERGY AND COMMERCE INDIANAPOLIS, INDIANA

FEBRUARY 10, 1984

H.R. 3400 - NATIONAL ACID RAIN DEPOSITION ACT

THANK YOU MR. CHAIRMAN. I WISH TO COMMEND YOU FOR BRINGING THE IMPORTANT, YET HIGHLY CONTROVERSIAL ISSUE OF ACID RAIN TO THE AMERICAN PEOPLE THROUGH THE UTILIZATION OF FIELD HEARINGS. I AM ESPECIALLY PLEASED THAT THIS IS BUT ONE OF THREE HEARINGS SCHEDULED FOR THE MIDWESTERN REGION OF OUR COUNTRY, WHERE THE BRUNT OF ANY ACID RAIN CONTROL DECISIONS MADE IN WASHINGTON, D.C., WILL BE FELT. I JOIN IN WELCOMING GOVERNOR ORR AND OUR OTHER WITNESSES TO THE PROCEEDINGS TODAY. I AM CONFIDENT THAT WE WILL ALL PROFIT FROM THE TESTIMONY WE ARE ABOUT TO HEAR.

RARELY HAS AN ISSUE COME BEFORE CONGRESS WHICH HAS BEEN SO POORLY UNDERSTOOD, CONTROVERSIAL AND DIVISIVE, AS THIS ISSUE OF ACID RAIN. IT HAS DIVIDED THE SCIENTIFIC COMMUNITY, PITTED REGIONS OF THE COUNTY AGAINST EACH OTHER, AND CAUSED MAJOR DISAGREEMENTS WITHIN POLITICAL PARTIES.

WE DO HAVE LAKES IN THE NORTHEASTERN U.S. AND CANADA WHICH ARE ACIDIFIED, AND WE SHOULD DO SOMETHING ABOUT IT.

BUT THERE CLEARLY DOES NOT NOW EXIST SUFFICIENTLY CONVINCING SCIENTIFIC OR ECONOMIC DATA WHICH JUSTIFIES CHARGING OFF BLINDLY INTO A MULTI-BILLION DOLLAR CONTROL PROGRAM WITH ALL ITS ADVERSE SOCIAL AND ECONOMIC CONSEQUENCES.

IT IS IMPERATIVE THAT WE REALIZE THAT ACID RAIN CONTROL IS NOT MERELY AN ENVIRONMENTAL ISSUE--IT IS ALSO A LABOR ISSUE. WE WILL HEAR FROM THE UNITED MINE WORKERS ABOUT THE POTENTIAL EMPLOYMENT IMPACTS OF ACID RAIN CONTROL LEGISLATION. THE FIGURES VARY, BUT EVEN UNDER THE SIKORSKI-WAXMAN COST SHARING PLAN, WE ARE FACING SERIOUS EMPLOYMENT IMPACTS.

ACID RAIN CONTROL IS ALSO A CONSUMER ISSUE. MAKE NO MISTAKE, UNDER ANY OF THE PROPOSALS PENDING BEFORE CONGRESS, ELECTRIC UTILITY RATES WILL RISE IN THE MIDWEST. UNDER H.R. 3400, FOR EXAMPLE, A 1 MILL USER FEE WOULD BE ADDED TO ALMOST ALL ELECTRICITY BILLS. BUT WHAT WILL THAT FEE PAY? SEVERAL ANALYSES SHOW THAT IT WILL BE INSUFFICIENT TO COVER EVEN THE 90% CAPITAL COSTS OF SCRUBBER CONSTRUCTION DURING PHASE I OF REDUCTIONS, AS PROPOSED BY THE LEGISLATION. OPERATION AND MAINTENANCE COSTS, WHICH WILL BE SIGNIFICANT FOR SCRUBBERS ON OLDER PLANTS, ARE NOT EVEN PART OF THE COST SHARING PROPOSAL. THE RESULT WILL BE THAT THE PEOPLE SERVED BY THE 50 UTILITY PLANTS SINGLED OUT IN THE WAXMAN-SIKORSKI BILL, WILL FOOT THE BILL. THE MASSACHUSETTS CONSULTING FIRM OF TEMPLE, BARKER & SLOANE HAS REPORTED THAT RESIDENTIAL ELECTRICITY RATES IN INDIANA WILL RISE 21% UNDER H.R. 3400. COMMERCIAL AND INDUSTRIAL RATES WILL RISE 24% AND 26% RESPECTIVELY. OBVIOUSLY, THESE COSTS WILL BE PASSED ON TO INDIANA RESIDENTS. WE MUST ASK WHETHER SUFFICIENTLY CONVINCING SCIENTIFIC PROOF ABOUT THE CAUSES AND EFFECTS OF ACID RAIN CURRENTLY EXISTS TO WARRANT ACTION THAT WOULD HAVE SUCH A DEVASTATING IMPACT ON MIDWEST CONSUMERS, WORKERS, AND INDUSTRIES.

ON JANUARY 25 OF THIS YEAR IN HIS STATE OF THE UNION ADDRESS, PRESIDENT REAGAN LAID OUT A COURSE THAT I, AND MANY OTHER MEMBERS OF THE ENERGY AND COMMERCE COMMITTEE, HAVE BEEN URGING FOR 3 YEARS.

FIRST, ACCELERATE RESEARCH INTO THE PHENOMENON OF ACID RAIN, SO THAT WE REALLY KNOW THAT ADDITIONAL MONIES SPENT ON EMISSION CONTROLS WILL RESULT IN SOME ENVIRONMENTAL BENEFIT.

SECOND, BEGIN A FEDERAL MITIGATION PROGRAM AT THE AFFECTED AREAS, INCLUDING LAKE LIMING AND FISH RESTOCKING. WE CAN IMPROVE THESE 200-ODD ACIDIFIED LAKES AT A VERY REASONABLE COST.

AND THIRD, ENCOURAGE THE DEVELOPMENT OF NEW TECHNOLOGIES TO CONTROL SULFUR DIOXIDE AND NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES IN AN EFFICIENT, COST-EFFECTIVE MANNER.

I WOULD LIKE TO BRIEFLY ADDRESS THESE THREE POINTS.

MR. CHAIRMAN, CONTRARY TO WHAT SOME WOULD HAVE US BELIEVE, THERE IS NO SCIENTIFIC CONSENSUS THAT MERELY CONTROLLING EMISSIONS IN THE MIDWEST WILL IMPROVE THE ACIDITY OF NORTHEASTERN LAKES. THE OFT-QUOTED NATIONAL ACADEMY OF SCIENCES (NAS) REPORT RELEASED LAST SUMMER CLEARLY STATES THAT ONLY IF EMISSIONS OF SULFUR DIOXIDE FROM SOURCES THROUGHOUT NORTHEASTERN NORTH AMERICA

WERE REDUCED BY THE SAME FRACTION, WOULD THERE BE A CORRESPONDING FRACTIONAL REDUCTION IN DEPOSITION. THAT IS ALL SOURCES EAST OF THE MISSISSIPPI, NOT JUST IN THE MIDWEST. FURTHERMORE, ONE SCIENTIST ON THE NAS PANEL HAS STATED THAT NONE OF THE BILLS INTRODUCED IN CONGRESS FOLLOWS THE RECOMMENDATIONS OF THE STUDY, AND THEREFORE NONE CAN POINT TO IT FOR SUPPORT.

SO IT IS CLEAR THAT WE NEED ADDITIONAL RESEARCH TO SOLVE THESE UNCERTAINTIES. JUST THIS WEEK I ENTHUSIASTICALLY SUPPORTED AN AMENDMENT TO THE ENVIRONMENTAL RESEARCH AND DEVELOPMENT AUTHORIZATION BILL TO MORE THAN DOUBLE EPA'S PORTION OF THE ACID RAIN RESEARCH BUDGET TO $35 MILLION. I AM CONFIDENT THAT THIS ADDITIONAL RESEARCH WILL SOON YIELD NEW DATA TO HELP CONGRESS DECIDE IF EMISSION CONTROLS, IN ADDITION TO THE STRICT MEASURES NOW CONTAINED IN THE CLEAN AIR ACT, ARE NEEDED.

I BELIEVE THAT THE SECOND POINT IN THIS PROGRAM, ON-SITE MITIGATION MEASURES AND FISH RESTOCKING, SERVES TO HIGHLIGHT THE CRUX OF THE ACID RAIN DEBATE. FEW PEOPLE MAY REALIZE THIS, BUT IF WE JUST ALLOW THE CLEAN AIR ACT TO WORK, RATHER THAN ADOPT ADDITIONAL EMISSION CONTROLS, EMISSIONS OF SO2 WILL DRASTICALLY REDUCE BY EARLY IN THE NEXT CENTURY. TRUE, IF WE DO ADOPT AN ADDITIONAL CONTROL PROGRAM NOW, WE WILL SEE REDUCTIONS IN THE 1990's, BUT BY THE YEAR 2010 OR SO, SO_2 EMISSIONS WILL BE REDUCED TO ABOUT THE SAME LEVEL WHETHER WE ADOPT THESE CONTROLS OR NOT, AND SO_2 EMISSIONS WILL BE EVEN LOWER BY THE YEAR 2007 IF WE DO NOT ADOPT AN ADDITIONAL CONTROL PROGRAM NOW, BUT WAIT FOR THE DEVELOPMENT OF NEW TECHNOLOGIES.

SO THE BASIC QUESTION IS SIMPLE: DO WE PAY HUNDREDS OF BILLIONS OF DOLLARS TO ARRIVE AT THE SAME PLACE IN 15-20 YEARS, OR DO WE SPEND RELATIVELY SMALL AMOUNTS OF MONEY TO MITIGATE THE DAMAGE WHICH HAS BEEN DONE AND ALLOW THE NEW SOURCE PERFORMANCE STANDARDS OF THE CLEAN AIR ACT TO WORK TO GREATLY REDUCE EMISSIONS. I SEE LITTLE EVIDENCE THAT WE NEED TO MAKE THE COMMITMENT TO SPEND MASSIVE AMOUNTS OF MONEY. IN FACT, THE LATEST SURVEYS BY THE NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION SHOW THAT LAKE ACIDIFICATION IN THE ADIRONDACK REGION HAS IMPROVED SINCE THE 1970's, WITH AN AVERAGE PH INCREASE OF 0.516 (5.622 to 6.138). FURTHERMORE, IN A 1980 SURVEY, ONLY 212 LAKES WITH A pH LESS THAN 5.0 WERE IDENTIFIED, AND ALTHOUGH THESE COMPRISED 25% OF THE LAKES SAMPLED, THEY ONLY ACCOUNTED FOR 4.7% OF THE LAKE SURFACE. FORTY-NINE OF THESE LAKES ARE PONDS (LESS THAN 10 ACRES), 159 ARE LESS THAN 40 ACRES, AND ONLY ONE IS CONSIDERED LARGE (GREATER THAN 1000 ACRES), AND LIKE MOST OF THE OTHERS, ITS ACIDITY HAS IMPROVED.

SO I DO NOT BELIEVE THAT WE ARE FACING AN IRREVERSIBLE PROBLEM. THIS DATA WOULD INDICATE THAT THE PROBLEM IS NOT GETTING WORSE IN THE NORTHEAST, AND THAT A MITIGATION PROGRAM CAN ADDRESS THE DAMAGE THAT HAS OCCURRED.

PERHAPS MOST IMPORTANTLY, WE MUST ENCOURAGE THE DEVELOPMENT OF NEW EMISSION CONTROL TECHNOLOGIES, AND THIS IS WHERE I CONSIDERABLE PROBLEMS WITH THE BILL, H.R. 3400, INTRODUCED BY MR. SIKORSKI AND CHAIRMAN WAXMAN.

IN AN ADMIRABLE ATTEMPT TO PRESERVE MIDWESTERN JOBS ASSOCIATED WITH THE MINING OF HIGH SULFUR COAL, H.R. 3400 REQUIRES FLUE GAS DESULFURIZATION UNITS, OR "SCRUBBERS", TO BE APPLIED TO THE 50 LARGEST EMITTING POWER PLANTS IN THE COUNTRY. I THINK WE CAN ALL AGREE THAT SCRUBBERS ARE INEFFICIENT, WASTE ENERGY, YIELD LARGE VOLUMES OF WET WASTE, AND ARE BASICALLY OUTDATED. UNFORTUNATELY, THIS IS THE ONLY TECHNOLOGY PROVEN TO ACHIEVE SIGNIFICANT SO_2 REDUCTIONS FOR LARGE COAL-FIRED BOILERS.

BUT, NOT FOR LONG. A NUMBER OF OTHER TECHNOLOGIES ARE EMERGING. THESE INCLUDE SELECT GAS USE , THE BURNING OF NATURAL GAS WITH HIGH SULFUR COAL IN THE SAME OR SEPARATE COMBUSTION UNITS; FURNACE LIMESTONE INJECTION, THE FEEDING OF DRY, PULVERIZED LIMESTONE INTO THE FURNACE WHERE IT REACTS WITH SO_2 TO FORM GYPSUM; FLUIDIZED BED COMBUSTION, WHICH FEATURES A SPECIAL FURNACE CONFIGURATION IN WHICH A MIXTURE OF FUEL AND LIMESTONE IS SUSPENDED AND CHURNED ABOUT IN AN UPWELLING FLOW OF AIR, CAUSING A REACTION WHICH CAPTURES THE EVOLVING SO_2; AND EVEN ELECTRON OR E-BEAM TECHNOLOGY. A PILOT PROJECT TO TEST THIS NEW PROCESS IS BEGINNING RIGHT HERE IN INDIANA. THE POTENTIAL COST AND ENVIRONMENTAL BENEFITS VERSUS SCRUBBERS ARE SUBSTANTIAL.

I FEAR THAT WE WILL DISCOURAGE RATHER THAN ENCOURAGE THESE NEW TECHNOLOGIES IF WE BEGIN A MASSIVE SCRUBBER RETROFIT PROGRAM. THE SOLUTION TO EFFECTIVE CONTROL OF SO_2 AND NO_x EMISSIONS LIES IN THESE INNOVATIVE METHODS, AND OTHERS LIKE THEM.

TO IMPLEMENT THIS THREE PART PLAN OF RESEARCH, MITIGATION AND NEW TECHNOLOGY, I WOULD LIKE TO HIGHLIGHT THE PRESIDENT'S FY 1985 BUDGET REQUEST. IN THAT REQUEST, THE PRESIDENT HAS COMMITTED $55.5 MILLION FOR RESEARCH, $5 MILLION FOR MITIGATION, AND $67 MILLION FOR CONTROL TECHNOLOGY RESEARCH, FOR A TOTAL OF $127.5 MILLION IN FY 1985 FOR EFFORTS TO ADDRESS ACID RAIN.

IN CLOSING, MR. CHAIRMAN, I AGAIN COMMEND YOU FOR HOLDING HEARINGS ON THIS IMPORTANT ISSUE BEFORE THE AMERICAN PEOPLE THROUGHOUT THE COUNTRY. ONLY IN THIS WAY CAN WE BE SURE THAT ALL OF THE FACTS SURROUNDING THE PHENOMENOM OF ACID RAIN ARE REVEALED. WE CERTAINLY MUST NOT FORGET THAT THIS IS NOT ONLY AN ENVIRONMENTAL ISSUE, IT IS A CONSUMER ISSUE AND A LABOR ISSUE. I KNOW THAT THE TESTIMONY WE WILL HEAR TODAY WILL VERIFY THIS FACT.

Mr. WAXMAN. Thank you very much, Mr. Coats.

Without objection, the testimony of Senator Quayle will be included in the record, and that will be the order.

[Testimony of Senator Dan Quayle follows:]

TESTIMONY OF
SENATOR DAN QUAYLE
BEFORE THE
SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT
COMMITTEE ON ENERGY AND COMMERCE
INDIANAPOLIS, INDIANA
FEBRUARY 10, 1984

Mr. Chairman, Members of the Committee:

Acid rain is a subject of great importance and concern in Indiana. I am pleased that citizens of this State have the opportunity to express their views before this Subcommittee. I regret that I am unable to attend today's hearing to deliver my testimony personally on this extremely important subject.

I believe that strategies to control sulfur dioxide emissions as a solution to the acid rain problem, such as those now under discussion in Congress, are premature and cannot guarantee to solve the problem. I believe that President Reagan heeded the voices of wisdom and reason in proposing a program of more research, mitigation, and development of new technology. Let me outline my reasoning in a bit more detail.

First, the scientific evidence does not justify stringent controls on the Midwest. Sulfur dioxide emissions have been declining in recent years. Nationwide, sulfur dioxide emissions would be 50% greater in 1980 than they actually were had efforts to reduce pollution not been made. In the Ohio River Basin, emissions have dropped 15 percent in the past decade. These reductions were achieved even though our nation's coal-fired electric generating capacity, the presumed villian in the acid rain debate, increased by almost 60 percent since the mid-1970's.

During this same time frame, the U.S. Geological Survey found very little change in the acidity of bulk precipitation. Data from the Hubbard Brook Ecosystem study, conducted from 1963 to 1977, indicate a decrease in sulfate concentrations and an increase in nitrate concentrations in rainfall, but did not indicate any trend in pH. While the National Academy of Sciences reported a relationship between emissions and deposition in the eastern North American continent, they could not determine the "consequences of emission reductions in a smaller region, such as the Midwest, for deposition in another region, such as the Adirondacks or southern Ontario."

The extent to which precipitation is the cause of acidified lakes remains an unknown. For example, in a study recently published in Science, two scientists with the Department of Soil and Water of the Connecticut Agricultural Experiment Station found that "natural soil formation is often more important than acid rain in determining the acidity of lakes and streams." The implications of historical agricultural usage and forest management practices has not been fully explored.

Clearly, such studies do not provide the support needed to justify crackdowns on the Midwest. Indeed, such control strategies may not produce the desired results or anything approaching the desired results.

Second, the control strategies now being discussed would place enormous burdens on Indiana and its citizens. My State was one of the hardest hit in the most recent recession. To impose stringent controls now would jeopardize our current economic upturn. It may even kill it.

The control strategies proposed are not fair to the Midwest. Consider S. 768, the 98th Congress' version of legislation reported by the Senate Environment and Public Works Committee in the 97th Congress, which requires an 8-million ton reduction in sulfur dioxide emissions. Even though New York and Kentucky have similar emission levels, this bill would require New York to reduce its sulfur dioxide emissions by only one-fourth as much as Kentucky; and New York is closer to the problem areas than Kentucky.

We need more analysis of the impact of local and distant sources on sensitive areas. The National Academy of Sciences stated that "the further a source is from a given reception site, the smaller its influence." The Hubbard Brook data may implicate NOx emissions more than sulfur dioxide, which could indicate that local sources, such as automobiles, are more to blame.

In addition to the source-receptor--local vs. distant pollution analysis, more study of petroleum use is needed to determine its precise influence on sensitive areas. The Northeast comprises less than 5 percent of the area of the lower 48 States, but it burns 36 percent of the distillate fuel and 40 percent of the residual oil in the United States. Consumption of oil by Northeastern powerplants has increased by a factor of about five since 1960.

In terms of cost, the General Accounting Office's study of a 10-million ton reduction plan placed the annual cleanup costs at $3 to $4.5 billion in 1980 dollars and projected the average increase in utility rates in the Eastern United States at 10 to 15 percent. However, the GAO qualified this estimate for those regions that depend on coal-fired generation. They would incur substantially higher costs.

For Indiana, the capital costs to build and retrofit existing generation capacity would have to be met. To the extent that utilities reduced their consumption of Indiana coal, coal production would fall and mine workers would lose their jobs. The Congressional Research Service has estimated that for a four-county coal mining region in Indiana "between 1500 and 1800 direct jobs" would be lost under one acid rain control plan. If scrubbers are mandated on some facilities, ratepayers would bear an additional burden. Those who are testifying before the Subcommittee today will provide more details on the hardships to Indiana's economy and citizens.

Finally, I have serious reservations about efforts to mandate scrubbers. I recognize the serious consequences that would befall the Indiana coal industry, the miners and their families, and the ripple effect on communities should low-sulfur coal displace Indiana coal. In a state that is seeing its basic industrial base eroded by intense foreign competition, we cannot afford measures which will increase our costs of production and our cost of living.

A preferred alternative to the draconian strategies some have proposed would be to accelerate the development of new technology for the clean-burning of coal. I am gravely concerned that any policy which mandates scrubbers would jeopardize the commercialization of more efficient technology. New methods to utilize coal would be to the benefit of ratepayers, the coal industry and miners, the utilities, the environment, and ultimately, the nation as well.

Concurrent to development of new technology, a sound and vigorous on-site mitigation program to ameliorate the impacts of ecosystem acidification should be pursued. Although not a cure-all, this would be an effective remedial measure in combatting lake acidification while we collect additional data.

Lake liming has been tried successfully in Sweden, Canada, and the United States. Data on 22 lakes and ponds in the Adirondack mountains that were limed from 1975-1979 indicate that the programs have improved pH, and brown trout survival is reported to be excellent. Another study has concluded that "most species affected by acidification respond positively and directly to liming," provided the pH levels are maintained. Research is also underway on Martha's Vineyard on the use of sea shells to treat acidified ponds. The environmental scientist conducting the experiment suggests that since the shells dissolve slowly, they will act as time-release agents in combatting acidity. One estimate of the cost of lake liming places the initial treatments at $100 per acre. This is a small fraction of the cost of the control programs before Congress, and its results are well documented.

In conclusion, I heartily support the President's recommendations as outlined in his State of the Union Address. Altogether, the President is requesting $127.5 million for Fiscal Year 1985 to address acid rain. The President announced efforts to double our research efforts on the science of acid rain. This can only lead to a greater understanding of the nature of the problem to aid policymakers in development of a more equitable solution. Five million dollars will be allocated to undertake mitigation efforts in the affected areas while the additional research is conducted. I strongly support the President's efforts to place emphasis on the development of cleaner and more efficient coal-use technologies. Indeed, this is the key to a solution to the acid rain dilemma.

Mr. Chairman, I appreciate this opportunity to share my views with this Subcommittee. I am certain the testimony presented today by my fellow Hoosiers will be beneficial to the Subcommittee's proceedings on the acid rain issue.

Mr. Waxman. The bill that is under consideration is H.R. 3400, which is a different bill than has been considered in the Congress in previous years, and the author of that legislation is a very distinguished member of our subcommittee.

And I would like to call upon him, at this point, for some comments. Congressman Gerry Sikorski from the State of Minnesota.

Mr. Sikorski. Thank you, Mr. Chairman. I am pleased to be in Indiana to discuss the issue of acid rain control legislation. Hopefully, this hearing will make it clear to the people of Indiana that all of us are sensitive to your special concerns, and at the same time, move closer to the passage of acid rain legislation that treats this national problem with a national solution.

Every day more than 165,750 tons of sulfur dioxide and nitrogen oxides are shot into the skies over the North American Continent. That is the equivalent of 4,144 fully loaded boxcars of these pollutants and, unfortunately, what goes up comes down, and comes down in the form of acid rain or deposition.

It's particularly important and appropriate that we come to Indiana to examine the issue of acid rain because, as already been mentioned, Indiana has the second dirtiest emissions of any State in the country. But you're not alone, and you're not being picked on. All States contribute to the acid rain problem. And, as I've told Minnesotans—and I come from Minnesota—and New Yorkers, and people in the Southwest, and over 600 environmentalists from 29 States last month, there isn't a State in this Nation that has clean hands when it comes to acid rain. Just as there is no State without vital resources being destroyed now, and damaged now, and even more at risk, and that includes Indiana's economic and environmental resources.

The polluters and some people in the Midwest, including some in Indiana, have raised a series of concerns about previous acid rain control strategies. Unions and public officials concerned about jobs have expressed fears that thousands of midwestern coal miners would lose their jobs, especially if massive fuel switching occurred.

Chairman Waxman, 120 other Members of the House of Representatives, and I, however, introduced H.R. 3400 to protect existing high-sulfur coal jobs. It also creates new manufacturing jobs and pollution control also in the Midwest, including Indiana. The Office of Technology Assessment has estimated that, under our bill, high-sulfur coal employment will actually move back up to 1980 levels.

Likewise, some midwestern public officials and utility companies have said that previously proposed acid rain controls would cause utility rates to skyrocket, driving people out of their homes with double digit rate inflation. So, the legislation that we've introduced spreads the cost of cleanup, and makes certain that no region of the country suffers dramatic rate increases.

Coming from the Midwest, I'm sensitive to the fact that we've just been put through the worst recession since the Great Depression.

Yet some still oppose acid rain control legislation. They defend, in action, by saying we don't know enough about the problem. Well, the scientific verdict has been given on acid rain, while we'll never have all the answers to acid rain, or any other human phenomena, absolute knowledge is something we don't have as human beings. We know that, unless we take concrete actions, now, it will be too late. We've already lost hundreds of lakes, thousands upon thousands of trees, endangered millions and millions of acres of forests and farms, and our inaction threatens the wildlife and the health of citizens of Indiana and the rest of the country.

Two years ago, the National Academy of Sciences estimated, in the Eastern part of America alone, acid rain causes over $5 billion in damages annually. And even more disturbing, scientists have recently turned up evidence that acid rain may be linked to brain degeneration, particularly, Alzheimer's disease. And we know that SO_2, the precursor of acid rain, the major cause of acid rain, causes over 50,000 premature deaths annually in the United States, and this includes people in Indiana.

This subcommittee has heard testimony that residents, in some part of the United States today are warned to flush their domestic water supply lines to avoid drinking toxic metals that are mobilized by acid rain.

For this past year, several major reports have been issued on acid rain which support immediate action on a national level. A panel of top American scientists, handpicked by the skeptics at the White House, reported to the White House that, and I quote:

> If we take the conservative point of view that we must wait until the scientific knowledge is definitive, the accumulated deposition in the environment may reach the point of irreversability.

We've had close to 6,000 studies on this issue, and, the time has come to question whether those who object to dealing with acid rain are raising legitimate concerns are simply trying to obfuscate the issue to obstruct a solution to delay and to destroy.

Our legislation would add a 1-mill fee to all nonnuclear electricity generated in the United States. The money collected will pay up to 90 percent of the one-time cost of installing scrubbers at the 50 largest, dirtiest powerplants; 7 are located in Indiana.

Utilities have been critical of this approach. In fact, they've been critical of doing anything on acid rain. They argue that it's not in the best interests of their consumers, which, to me, has been a strange way of a fiscal responsibility. They'll spend consumer's money fighting legislation to stop acid rain, but they won't spend a dime to prevent it.

Will Rogers had a comment about this style of business management. He said, "There are men in business that don't belong in business any more than the Government does, and that's why the Government goes in."

It's interesting to hear the same interests that opposed the passage of the Clean Air Act over a decade ago, and since encourages gutting and still encourage major modifications that would weaken it, now say that the Clean Air Act is working, and we don't need acid rain controls. These same people now say we shouldn't do anything about acid rain. They tell all kinds of horror stories. But just as passage of the Clean Air Act and other major environmental laws in this country did not stop economic growth, did not destroy jobs, did not skyrocket utility rates, or cause other terrible consequences predicted by its opponents, neither will acid rain control legislation, and, especially, neither will H.R. 3400.

H.R. 3400 protects jobs, spreads the costs of the acid rain control. A recent Louis Harris poll found that Americans by, I believe, it's 90 to 7—90 percent to 7 percent want acid rain cleaned up. Midwesterners, like the other three-fourths of Americans who want tough acid rain control legislation, are willing to pay for it, are willing to pay 20 times—20 times what we're talking about for acid rain cleanup here. Seventy-eight percent of the midwesterners—and this is more than in New England, where the damage has already occurred and the debate has been focused—are willing to pay their share, and for good reasons. Midwesterners get the bulk of the pollution, the most acidic of the acid rain. The Academy of Sciences has told us that the greatest benefit from cleaning up occurs in the areas nearest the smokestacks. When Indiana emissions are reduced, Indiana benefits, and under H.R. 3400, they get hundreds of millions of dollars to help in the cleanup.

Mr. Chairman, when we visited the Northeast a few weeks ago, we were told "Do something about acid rain. Help us protect our lakes, but we shouldn't have to pay for it." When we were in Minnesota, we heard the same message. We've already cleaned up, but why should we have to pay twice. And while traveling in the South and Southwest, I've heard "We shouldn't be paying for acid rain control since we don't have a problem."

We've even heard it from pollution control officials in Ohio, the State with the greatest amount of SO_2 emissions.

The truth is, everyone contributes, to some degree, to the problem of acid rain. Every State has dirty hands. Every State allows utilities to pump millions of pounds of SO_2 and NO_x into their air every day. Every State is part of our national economy and our national Government. Every State is a part of a national utility grid which depends on dirty powerplants, and every State will have to share in the cost.

I expect we'll hear a lot about what Indiana has already done, and that's good. And I expect we'll also hear the traditional litany from polluters that we don't know enough that jobs go and rates will skyrocket. And I expect we'll also hear something that we've just heard recently, that we need even more help. Your bill is good, but we need more than $20 billion. It isn't enough.

Well, if I could get one little message in early before the—we hear the testimony that we're here for, it's simply that the acid rain train is leaving the station. Americans, by over 9 to 1, want controls now. We want to help, but they're not going to be a rip-off. If Indiana wants to have its voice heard in the debate, now is the time to get on the train. And, as a midwesterner, I don't want midwestern interests left standing at the station waving goodbye to the acid rain train. I'm not saying H.R. 3400 is perfect as introduced. We want to work with the Indiana Congressional Delegation, and you have some of the finest members in Congress representing you, and we want to work in a spirit of cooperation to better this legislation, but we need to act quickly to save the country's precious natural resources from an environmental disaster and economic disaster, and we will act. Our Nation's lakes and our lungs, our forests, and our farms, our economy, and our people's health, Hoosiers and all Americans are at risk and cannot afford the continued daily assault by acid rain.

Thank you, Mr. Chairman, for your wise leadership on this, the most important environmental issue of our decade.

Mr. WAXMAN. Thank you very much, Mr. Sikorski. You mentioned that Indiana has an outstanding delegation to the House of Representatives. One of the members of that delegation, a new but very distinguished one, and a member for whom we have a great deal of respect, is Congressman Frank McCloskey, and I'm going to welcome him as our first witness today.

Mr. McCloskey, if you would come forward.

STATEMENT OF HON. FRANK McCLOSKEY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

Mr. McCLOSKEY. Thank you very much, Mr. Waxman. Mr. Chairman, it's, indeed, an honor to be here today. I must commend the statements of all four of you. They were wise, cogent, forthright, and were really of benefit to all of us. I specifically want to say that whether most people in the audience realize it or not—and I know many of the informed people here do—that we're especially honored to have this committee here today. We, in Washington, know it is routinely stated by the Washington Post as being the most powerful committee in Congress.

In Henry Waxman, we have a master and astute legislator who is a champion of health concerns and the environment. I particularly want to commend Mr. Waxman I know from my dealings with him that he is concerned about the environment and he is very, very concerned about the economics and jobs of the Midwest. So, I would say that neither the environmentalists, nor those concerned economically, have anything to fear from Henry Waxman. Indeed, it is true that in the politics of the Energy and Commerce Committee and on the Hill, generally, he is taking on an overwhelming task of trying to reconcile regional environmental and economic interests in a very courageous way. Nationally and locally, Henry, we are all grateful to you for that. So, I just can't thank you enough. And this is a wonderful thing you are doing.

In my case as the Representative from the Eighth District, we produce most of the coal in Indiana. There were about 22 million tons of Indiana coal mined in the Eighth District last year, most of which was high-sulfur. The very, very sincere concerns for acid rain come at a time when, as Mr. Stilwell, and perhaps other people from the mine workers will tell you today, we have, approximately, 35-percent unemployment in our minefields. Approximately 1,500 miners are out of work. We have very, very grave concerns about the major economic base for about six counties in the district. So, as a concerned environmentalist, I also have to be very, very sincerely and strongly concerned about the environment of the Eighth District.

At the same time, I think your points were very well taken about acid rain being not only a Northeast or a Canadian problem, it's also a midwestern and Indiana problem, indeed, more and more. Quite frankly, I've had farmers in the Eighth District come to me with concerns about melon blight possibly substantially or partially due to acid rain.

And just the fact that the chairman would take on the job of trying to handle this problem nationally with a national subsidy program is commendable. I really hope the essence of your statements as to the job impact on Indiana is correct. I think that will be the real challenge, Mr. Chairman, for you to get across here today. In effect, if your figures will hold up that it is not going to be a loss of jobs; that it will actually be of benefit for the Indiana mining industry, the workers, the operators, and the general economy of the district, I am very, very hopeful.

However, I must be very candid, Mr. Chairman, as I mentioned to you this week, so many of the source materials— so much of the sources that we have reviewed previously show production losses as high as 50 percent in our Indiana coal, job losses of perhaps 10 to 20 percent, or more. So, to me, that will be the great challenge to address the folks' concerns for jobs and the economy of the district. If that is settled, surely there are great hopes for your legislation.

At this time, given some of the concerns that our distinguished colleague, Mr. Sharp, has raised, I don't feel it quite possible yet to be a cosponsor. I commend you on pushing this as much as you have. I do have a more formal statement for the record. But basically I am very hopeful. I think you are helping this area and the Nation. And I hope your estimates of the situation are correct, Mr. Chairman.

[Mr. McCloskey's statement follows:]

Statement of Congressman Frank McCloskey

I want to thank Henry Waxman for his work in bringing these hearings to Indianapolis today in order that we in the Midwest can get a better look at some of the remedies being proposed in the acid rain controversy. Congressman Sharp and Congressman Coats have also worked closely on this issue by virtue of their Committee assignments.

My interest is simple and direct. The economic future of the 8th District is at stake.

An acid rain control program--if one is enacted--no matter how well intentioned, could devastate Indiana's economy. I know, however, that Congressman Waxman does not intend to obtain a solution which would carry with it these results. However, from the material I have reviewed--OTA, CRS, ICF, the EPA, the UMW, Hoosier Committee on Economic Development, coal companies and other interested parties--there appears to be a gulf between analysis and prediction. Hopefully, one outcome of this hearing today will be to arrive at a new consensus in understanding the problem and the proposed solutions.

Although I am not a cosponsor of H.R. 3400, Congressman Waxman's legislation, it does contain funding concepts for acid rain clean-up which are worth exploring. I am a cosponsor of H.R. 1405 and H.R. 4182, legislation which also address the problem of clean-up.

When I first began to review the economic consequences of certain acid rain control plans, the information was nothing less than horrifying. For Knox, Pike, and Warrick counties, already hard-hit by unemployment in the coal fields, additional job losses resulting from

"ONLY" AN 8 MILLION TON SO2 REDUCTION WERE ESTIMATED TO BE AS HIGH AS 8,300 DIRECT AND INDIRECT JOBS ACCORDING TO THE CONGRESSIONAL RESEARCH SERVICE. THIS WAS, OF COURSE, CALCULATED ASSUMING NO SUBSIDY WAS PROVIDED FOR INSTALLING POLLUTION CONTROL EQUIPMENT AND "AVOIDING THE SCRUBBER-SWITCHING DILEMMA." OTHER STUDIES PLACED THESE FIGURES MUCH HIGHER. THIS ONLY CONFIRMS THE FACT THAT HIGH SULFUR COAL IS THE LIFE-BLOOD OF THE ECONOMY OF SOUTHWESTERN INDIANA WHERE OVER 70 PERCENT OF INDIANA'S COAL IS MINED.

OF COURSE, THE MITIGATING FEATURE OF H.R. 3400 IS TO TARGET POWER PLANTS WITH HIGHEST SO2 EMISSIONS AND PROVIDE A 90 PERCENT SUBSIDY FOR THE INSTALLATION OF SCRUBBERS. THIS WILL ASSURE THAT AT LEAST 50 PERCENT OF INDIANA'S COAL PRODUCTION IS MAINTAINED. BUT EVEN NOW UNEMPLOYMENT IN THE COAL FIELDS REMAINS AT HIGH LEVELS.

IN ADDITION, THE UTILITY RATE INCREASES WHICH ARE A NECESSARY INGREDIENT OF SUCH A SUBSIDY PROGRAM ARE ALSO FEATURES WHICH MUST BE RIGOROUSLY REVIEWED. FOR INDUSTRIES, THIS COULD BE A REASON TO EXPAND OR NOT TO EXPAND OPERATIONS; LOCATE OR NOT LOCATE INDUSTRIAL ACTIVITIES. AGAIN, IN THE 8TH DISTRICT, LARGE PLANTS SUCH AS ALCOA IN WARRICK COUNTY ARE ESPECIALLY SENSITIVE TO SUCH RATE CHANGES AND COULD BE ADVERSELY AFFECTED BY THE WRONG KIND OF ACID RAIN CONTROL PROGRAM.

FINALLY, IT SEEMS TO ME THAT IN ADDITION TO THE POTENTIAL PROBLEMS POSED BY SOME CONTROL PROGRAMS, THERE ARE ALSO EXCITING OPPORTUNITIES.

IT WASN'T LONG AGO WHEN COAL WAS TO BE "KING" OF THE NATIONAL ENERGY AGENDA. UNFORTUNATELY, OUR POST-ENERGY CRISIS MENTALITY HAS DULLED OUR SENSES SOMEWHAT TO THE URGENCY OF ENERGY SECURITY. HOWEVER, THE PROBLEM IS STILL HERE. AND SO IS THE SOLUTION--17 BILLION TONS OF RECOVERABLE RESERVES BENEATH OUR FEET IN INDIANA ALONE. SO THE ONLY POINT I WOULD ADD TODAY IS THAT IF WE EVER ARRIVE AT A CONSENSUS ON ACID RAIN CONTROL, WE SHOULD ALSO PROVIDE WHATEVER TAX INCENTIVES OR RESEARCH SUPPORT ARE NECESSARY TO BRING PROMISING COAL-BURNING TECHNOLOGIES TO THE COMMERCIALIZATION STAGE. THAT WILL BE BETTER FOR THE ECONOMY AND THE ENVIRONMENT; FOR COAL MINERS AND COAL OPERATORS; FOR INDIANA AND THE NATION. CERTAINLY, INDIANA MUST NOT BE TREATED LIKE A STEPCHILD OF THE NATIONAL ECONOMY. TODAY WE HAVE AN OPPORTUNITY TO REASON TOGETHER AND ULTIMATELY BRING ABOUT A NATIONAL SOLUTION THAT WILL NOT FURTHER DAMAGE OUR ALREADY BATTERED ECONOMY IN THE MIDWEST.

CONGRESSMAN WAXMAN IS TO BE COMMENDED FOR SEEKING A NATIONAL APPROACH TO SOLVE THIS PROBLEM AND FOR HIS CONCERN ABOUT EMPLOYMENT IN OUR REGION AS EVIDENCED BY HIS WORK ON THIS ISSUE.

Mr. WAXMAN. Mr. McCloskey, I want to thank you first of all for the very kind words you said about me, personally; I do appreciate that.

But you are expressing, I think, something that we have to keep in mind. And that is the fact that you have had such high unemployment, particularly among the coal miners in this area, and we cannot add to the tremendous pain and suffering of people who are out of work, and look at the future with a sense of despair by adding to their burdens.

We have got the problem of acid rain, and a question we have to deal with is how to combat that problem without creating a new one that can be just as devastating.

And so we are trying to balance these equities, balance these concerns. We think we have come up with a bill that will improve the job situation and not to hurt the people who have already been hurt so badly by the economic situation. And we want to make sure those numbers hold up. We want to make sure that what we are doing is going to accomplish what we want to accomplish. With your constant reminders to us that we had better be sensitive and not move forward without thinking these things through, I hope we will end up with a product that will accomplish what is legitimate for all of us. I appreciate the contribution you are making to this effort and the fact that you're willing to be here with us today.

Mr. Sikorski.

Mr. SIKORSKI. I'd like to comment, I've gotten to know Frank well. We began together. We both began this process in Congress, in the 1982 election, and we come from similar backgrounds. My father was a laborer for the railroad for 32 years. I've witnessed Frank's representation as concern—intense concern—agonizing concern over the people he represents; their hopes, and dreams, and fears, and anxieties. And that concern has been manifested in an intelligent, articulate, tough, and very important voice in the House of Representatives. And I'm proud to be a member of the same class.

Mr. McCloskey. Thank you, Mr. Sikorski. I might mention that Mr. Sikorski is also a Democrat. In fact, he's the freshman Democratic whip, and, also, obviously, he's doing very well out there. I would just say——

Mr. Sikorski. Will it hurt you if I tell them you voted for me for freshman whip?

Mr. McCloskey. I think I did.

Mr. Sikorski. It was a secret ballot, so I don't know.

Mr. McCloskey. I guess the bottom line for me, Mr. Chairman, that you, unfortunately, would get a lot of opposition from even very, very sympathetic people, as you know, if there were to be a job loss and further economic trouble. But, from your presentation today, I'm very hopeful.

Mr. Waxman. We, as oldtime politicians, know that as much as we like each other personally, that's not going to affect your decision when you're representing your people. You want to make sure that they're protected, and we have to respect that to make sure that we satisfy you, and we'll attempt to do that.

Mr. McCloskey. I'll really know you have the job done when Nick Joe Rahall signs on, so, I'm looking forward to that.

Thank you.

Mr. Waxman. Thank you. Our first witness today is scheduled to be the Governor, but he is going to be a little late, and so, we're going to move now to call forward the Indiana State senator, Hon. Doug Hunt, to be with us and present his views. Senator Hunt?

[No response.]

Mr. Waxman. Is Senator Hunt here? Is Governor Orr here? Well, they're both in conference, I'm sure.

We will then move forward on the agenda.

I'd like to call forward Greg Silver, from the Sierra Club; Nancy Smith, president of the League of Women Voters in Indiana; Dr. Steven Jay, Indiana State Lung Association; and Fred Widlak from the Izaak Walton League of America.

If you would come forward and take seats.

Mr. Silver, why don't we begin with you.

STATEMENTS OF GREGORY K. SILVER, COUNSEL, HOOSIER CHAPTER, SIERRA CLUB, AND ALSO ON BEHALF OF NORA COMMUNITY COUNCIL, INC.; NANCY SMITH, PRESIDENT, LEAGUE OF WOMEN VOTERS OF INDIANA: STEPHEN J. JAY, M.D., ON BEHALF OF AMERICAN LUNG ASSOCIATION OF INDIANA; AND FREDERICK W. WIDLAK, PH.D., ON BEHALF OF INDIANA CLEAN AIR COALITION

Mr. Silver. Thank you, sir.

Chairman Waxman and members of the committee, I'm very honored to have been asked by your committee to give testimony on acid rain today. My name is Gregory K. Silver. I live here in Indianapolis, and am legal counsel for the Sierra Club, Hoosier chapter, having approximately 3,000 members in Indiana, and about 350,000 members in the United States and Canada.

I'm also representing a unique organization, the Nora Community Council, Inc., a neighborhood group of suburbanites on the northern part of this city composed of several hundred families who are vitally concerned about the quality of life in Indiana.

Both the groups I represent, and am a part of, are aware of the complex issues created by sulfur dioxide and nitrogen oxide emissions from fossil fuel power plants, and automobiles, trucks, and buses, respectively. But both insist that there is an abundant amount of clear and unmistakable evidence from the authorities, like Ulrich and Vogelmann, the National Academy of Sciences, the Reagan administration Advisory Panel on Acid Rain, and others, that acid rain is a real threat to this country's future, and that includes from its dry particulates, rain, snow, fog, dew, and ozone, all its manifestations, because it is getting into our air, it's getting into our forests, our crops, our drinking water, and affecting the health of our citizens, and it is affecting our economy now.

We no longer need additional evidence and research to know whether the atmosphere is loaded with sulfite. We know it is, and we know we have the technology to clean it up.

Bold action is required now on acid rain. It is ridiculous to argue that perhaps years of additional research is necessary before the Congress may begin to act to combat acid rain with a comprehensive strategy a long term strategy. Some would require irrefutable evidence of its causes and effects. This argument was put forth, as we've heard, with all the environmental acts of the 1970's, including the Clean Air Act. If we waited on those problems, our environment would be in worse condition today. Those laws have succeeded in real ways and there was no guarantee then that there would be a 100-percent cure, or 100 percent cause-effect relationship as the laws were passed.

That's the real question before you today—how fast and how far to go to solve an existing problem that is causing, at least $5 billion in damages yearly, and that was several years ago when the estimate was made by the Academy of Sciences, and how that affects forests, buildings, water, crops, and health. Here in Indiana, buildings in Indianapolis are being affected by acidity, so are our forests.

We must have legislation that is fair and reasonable, and that balances all interests with the cost of the reduction of emissions minimized, but the benefits of such maximized.

My two organizations do endorse the Waxman-Sikorski bill. The Nora Community Council, the neighborhood group, likes the cost of the cleaning of acid rain being spread among the Lower 48 States, and reflects public opinion expressed over and over again, that they want clean air, and are willing to pay for it.

The Sierra Club, because of our work on Capitol Hill, goes further. It endorses H.R. 3400 and asks it even be strengthened, perhaps with amendments that will clean up more of the emissions.

The results of a 50-cent- to a $1-per-month user tax doesn't seem to me to be prohibitive for even the poorest of citizens. But there may be subsidies you can work out, discounts that would help, as we have done with other laws.

But the most important thing is that it preserve and encourages the coal industry in Indiana. Not only will the coal-related jobs under this bill, as I understand it, be maintained in high-sulfur coal industry, but more jobs ought to be created, as your charts show and your projections from the computers have shown as other technology, as well as scrubbers, are used to clean up the high-sulfur coal and make it usable with the cleaner western coal. The bill is just what the industry really needs here in Indiana. It's a moderate bill and it encourages the industry. It does not hurt Indiana coal miners in its intent. The bill, is acceptable for economic reasons alone.

It provides a 90-percent Federal funding mechanism, which is very generous indeed to the polluters. It's fair and reasonable when one considers what they've been doing to our environment.

But it also mandates each State to work to reduce emissions not reduced by the scrubbers in proportion to that State's present emissions.

And, as we know, it applies tougher standards for new powerplants and on trucks, in model year 1986 to compare with auto emissions.

The goal, as your charts show, is a 50-percent reduction in sulfur dioxide emissions, and a reduction of 14 million tons in sulfur dioxide and nitrogren oxide by the 1990's at which point, as I understand it, the national tax on electricity would cease.

It will take a good while to put your H.R. 3400 into effect, even if the bill were passed today. While this is going on and the debate continues, the Federal Government must continue to provide encouragements to these new cleaning techniques for utility stacks, such as dry scrubbing, limestone injection, and fluidized bed. Any and all new technology must be encouraged. In fact, as we know, Indianapolis Power & Light Co., in Indianapolis, is doing exactly that with a DOE grant by dry scrubbing. Much more is needed by others.

We also need to require mandatory coal washing and limestone placement in waters as interim measures.

Aside for the protection of coal jobs in high sulfur coal industry, and the minimal increasing of utility bills, H.R. 3400 provides a massive amount of Federal dollars for Indiana. This is what we really should want. The bill will make certain that Indiana's own forests, crops, waters, health, and buildings do not deteriorate further. And I would cite you to a new study by the Holcomb Research Institute, dated this month, which shows, in fact, that Indiana is being very much affected by acid rain, sulfate aerosols. The issue not only is how much emissions we're sending east—the question is also how much we're getting here ourselves.

One final comment: The relationship between this State and the country of Canada is not good. The Canadians have been furious that Indiana has not adequately controlled its emissions, and they have come here to protest.

H.R. 3400 should be able to resolve this historic friendship among old friends, and get new investments from Canada for Indiana and for the United States. So long as we're sending Canada dirty air, or they perceive that they are getting more dirty air than they are sending us, they will not be friendly to us.

In conclusion, my clients endorse H.R. 3400's intents and purposes. What is needed is a long-term control strategy and program aimed at significant reduction of sulfur and nitrogen emissions. As fossil fuel utilities, autos, trucks, and buses are the major sources of these emissions, they are the target of any control strategy.

Thank you.

[Mr. Silver's prepared statement follows:]

STATEMENT OF GREGORY K. SILVER, LEGAL COUNSEL FOR THE SIERRA CLUB, HOOSIER CHAPTER, AND FOR THE NORA COMMUNITY COUNCIL, INC. OF INDIANAPOLIS CONCERNING ACID RAIN LEGISLATION PENDING BEFORE THE HEALTH AND THE ENVIRONMENT SUBCOMMITTEE OF THE ENERGY AND COMMERCE COMMITTEE OF THE U. S. HOUSE OF REPRESENTATIVES AT INDIANAPOLIS, INDIANA ON FEBRUARY 10, 1984.

Chairman Waxman and Members of the Committee. I am very honored to have been asked by your Committee to give testimony on Acid Rain today.

My name is Gregory K. Silver, and I live here in Indianapolis and am the legal counsel and representative for the Sierra Club, Hoosier Chapter having approximately 3,000 members in Indiana and 350,000 members in the U.S. and Canada. I also am representing the Nora Community Council, Inc., a Marion County land use and neighborhood organization composed of several hundred families and businesses vitally concerned with the qualify of life in our community.

The Challenges and Consequences of the Problem of Acid Rain

Both of the groups I represent, and am a part of, are aware of the complex issues created by sulfur dioxide and nitrogen oxide emissions from fossil fuel power plants and automobiles, trucks and buses respectively. But both insist that there is an abundant amount of clear and unmistakable evidence from Ulrich, Vogelmann, the National Academy of Sciences, the Reagan Administration advisory panel on Acid Rain and others that acid rain is a real threat to this country's future as that relates to its air, its forests its crops, its drinking water, the health of its citizens and its economy. We no longer need additional research to learn whether the atmosphere is loaded with sulfur dioxide - we know it is - and we know we have the technology to begin immediately to clean it up.

Bold action is required now on acid rain. It is ridiculous to argue that perhaps years of additional research is necessary before the Congress may begin to act to combat the acid rain problem with a comprehensive strategy. Some would require irrefutable evidence of its causes and effects. This argument was put forth in 1970 to oppose the Clean Air Act, and against the Clean Water Act, the Safe Drinking Water Act and so many other environmental laws which have, subsequent to passage, succeeded in real ways. If we had waited on those problems, our environment would have been badly damaged. Thus, the real question before us today is how fast and how far to go to solve an existent problem which, according to the National Academy of Sciences, is costing the taxpayers of this country $5 billion a year in damages to our forests, our waters, our crops, our health and our protection of our buildings and monuments so sensitive to acidity. We must have legislation that is fair and reasonable, that reduces emissions so that the cost of reduction is minimized but the benefits are maximized.

H. R. 3400 - "The Waxman-Sikorski-Gregg" Bill

The Sierra Club and Nora Community Council are in favor of H.R. 3400 for several reasons. The Nora Community Council likes the cost of the clean-up of acid rain being spread across the lower 48 states on all consumers of fossil fuels and reflects public opinion, expressed over and over again, that it supports "clean air" and is willing to pay a fair sum to get it. The Sierra Club because of its direct involvement as a lobbyist on Capitol Hill, goes further on the issue. It endorses H.R.3400 - The National Acid Deposition Control Act of 1983 - perhaps with strengthening amendments - not only because it distributes the cost of clean-up throughout the country but because:

1) it results in a new user tax of 50¢ to 75¢ per month for the average residential users of non-nuclear generated electricity. It will cost $5.5 billion per year, but we're losing $5 billion a year in damages right now.

2) it preserves the vitally important coal mining industry and jobs in Indiana. Not only will coal related jobs under this bill be maintained in the high sulfur coal industry, but more jobs ought to be created as scrubbers are installed and other technology is used to clean high sulfur coal and make it competitive with the cheaper and cleaner western coal. The bill is just what the industry needs and it provides a real future for Indiana coal. We Hoosiers should embrace this bill - accepting it for purely economic, if not the environmental reasons. We need H. R. 3400 in Indiana and we need it right now.

3) it provides 90% federal funding to do this clean-up of acid rain. The private industries who are the actual polluters only have to put up 10% of the cost and maintain the scrubbers or other technology put into place. This is a fair and reasonable partnership, remembering they are polluters.

4) it mandates that each state also work to reduce its emissions not reduced by the scrubbers in proportion to a state's present emissions. This is certainly reasonable with the federal government leading the way.

5) it applies tougher standards for new power plants and brings new trucks, in model year 1986, under the same emissions requirements as cars - all quite reasonable.

H. R. 3400 should achieve the desired 50% reduction in sulfur dioxide emissions and reduction of 14 million tons in sulfur dioxide and nitrogen oxide emissions by the 1990's - at which point the national tax on electricity previously cited would cease.

Interim Needs

It will take a good while to put the requirements of H.R.3400 into place, even if the bill were passed today. While this is going on and the debate continues, the federal government must continue to provide encouragements to new cleaning techniques for utility stacks such as dry scrubbing, limestone injection multistage burning and fluidized bed combustion. Any and all new technology must be encouraged. In fact, one utility here in Indianapolis recently obtained a DOE grant for dry scrubbing. Much more of this is needed.

Also, we must require mandatory coal washing and limestone placement in waters, as possible.

How H. R. 3400 Will Help Indiana

Aside from the protection of coal jobs and the high sulfur coal industry and the minimal increasing of utility bills, the bill provides a massive amount of federal dollars to Indiana to install the scrubbers and technology. The bill will make certain that Indiana's own forests, crops, waters, citizen's health, and its own buildings and monuments do not deteriorate from the acidity, as is occuring elsewhere in the country and world. For, as the scientists have said, its all a matter of degree and accumulation of concentrations of acidity which finally causes the problem of acid rain and damages, and this can happen to Indiana too - even with all our limestone -

when the greater concentrations occur here.

Dr. Noye Johnson, in testimony before the U. S. Senate Committee on Environment and Public Works, #97-H53 on May 25 and 27, 1982 at p230 states:

> "High acid concentration enables reactions to take place that otherwise would not . . . "

These reactions have caused dead lakes, fish, and forest damages in the northeast, Minnesota and Canada. We do not need that here. H.R. 3400 will protect us.

One final comment. The relationship between the state of Indiana and the country of Canada is not good. The Canadians have been furious that Indiana has not adequately controlled its emissions that they have come here to protest. H.R. 3400 should be able to restore this historic friendship among old friends and get new investments for Indiana from Canada which investments are not available so long as we send Canada dirty air or they perceive it coming from us.

Conclusion

In conclusion, my clients endorse H.R. 3400's intent and purposes. We want to see the law function to reduce sulfur dioxide emissions by 50% by the 1990's, and reduce sulfur dioxide and nitrogen oxide by a combined 14 million tons per year by the 1990's.

What is needed is a long-term control program aimed at the significant reduction of sulfur and nitrogen emissions.As utilities, cars and trucks are the major sources of these emissions and of acid rain, they are the target of any control strategy.

H.R. 3400 must be strongly supported, and even strengthened. Thank you.

Mr. **Waxman**. Thank you very much, Mr. Silver.
Ms. Smith.

STATEMENT OF NANCY SMITH

Ms. **Smith**. Thank you very much, Mr. Chairman.

I'm Nancy Smith. As president of the League of Women Voters of Indiana, I appear before you today to voice the league's support for H.R. 3400, the acid rain control bill. The league feels that this bill represents a reasonable compromise between the national effort to control the hazards of acid rain in an equitable, nationwide distribution of the costs of this cleanup effort.

I'd like to, briefly, address four points now: the costs of cleanup, the hazards of acid rain, the effects upon Indiana, and jobs and the economy.

Cost of cleanup: H.R. 3400 would spread the costs of acid rain reduction by imposing a 1-mill fee on each kilowatt hour of nonnuclear electricity generated. This fee would be paid by consumers in all the 48 contiguous States, and would cause an increase of up to 75 cents per month for the average consumer; a price that we feel is a reasonable one to pay for protecting our environment; 90 percent of the capital costs of installing scrubbers and other control equipment would be financed by this fee.

In light of the economic realities of Indiana, a heavy industry State which is hard hit by recession and high unemployment, we feel that it is the responsibility of all citizens of our Nation to share in the costs of acid rain cleanup, since they are the beneficiaries of the manufactured goods and agricultural products of our State.

By the same token, however, Indiana cannot ignore the economic impact of acid rain upon the crops, forests, lakes, and streams of our Eastern States and Canada.

The hazards of acid rain: The league is convinced that acid rain is a critical national problem which must be addressed without delay. Studies of the National Academy of Sciences, amongst many others, convince us that there is a definite cause and effect relationship between sulfur and nitrogen oxide emissions and acid rain damage. We realize that there are those who would discredit these studies claiming that not enough research has been done; however, the league feels that if we wait until we totally understand this phenomenon, and few such phenomena are ever totally understood, the damages of acid rain may be irreversible, or far too costly to remedy.

The effects upon Indiana: We would also point out the effects of nitrate and sulfate emissions upon Indiana, since not all of these pollutants are carried off to the Eastern States. Acid rain readings as low as 4.0 pH have been taken in the northwest region of Indiana and also right here, in Indianapolis, by the Indiana State Board of Health. The damage of acid rain to our soil and water has thus far not been well documented, since the high alkalinity of our soil buffers the effects of the acid rain.

Still, however, the existence of high concentrations of these pollutants in our air is a known threat to our residents' health, causing respiratory illnesses and aggravating chronic lung conditions, such as asthma and emphysema, and I believe the Lung Association will describe those further.

Jobs and the economy: As a multi-issue organization, the League of Women Voters is also very concerned about the impact of this legislation upon Indiana's serious unemployment problems.

We feel that H.R. 3400 will protect jobs in southwest Indiana's coal mining industry by requiring that scrubbers be installed, thus permitting the use of Indiana's high-sulfur coal.

In the words of one of our local league members, and I quote, "It would be wrong to discriminate against those living in a State which, by accident of geography, has historically depended upon its own fossil fuel deposits for electric power."

I'd also like to point out, briefly, that, in 1981, an Indiana Legislative Interim Committee on Coal Use, comprised of legislators living in coal mining areas in Indiana, recommended that the Clean Air Act retain the SO_2 reduction by requiring scrubbers and, thus, allowing the use of Indiana coal.

In summary, we feel that H.R. 3400 makes important strides in protecting our health and environment while preserving jobs and protecting the threatened economy of the Midwest industrial States.

On behalf of our 32 local leagues in Indiana, I thank this committee for an opportunity to present our views on this issue.

Mr. WAXMAN. Thank you very much, Ms. Smith, for that testimony.

I'd like to call on Dr. Jay for his presentation.

STATEMENT OF DR. STEPHEN JAY

Dr. JAY. Thank you, Mr. Chairman, and members of the subcommittee.

Mr. WAXMAN. For the information of our guests here, we do have a clock. We've asked each witness to make the oral presentation in 5 minutes, even though the written testimony may be more extensive. That will enable us to hear from all the witnesses and have a discussion.

Excuse me for interrupting you, but, if you hear a ring and you're testifying, please try to use that as a benchmark for concluding the oral testimony. We are not taking that out of your——

Dr. JAY. Mr. Chairman, you've reset the clock——

Mr. WAXMAN. My comments will not come out of your time.

I will reset it.

Dr. JAY. It's an honor to appear before the subcommittee and present testimony. My name is Stephen Jay. I'm a practicing physician, an internist and pulmonologist in Indianapolis. I was born and raised here, and have practiced most of my career in the State of Indiana.

I'm here today representing the Indiana Lung Association and the medical wing of that, the Indiana Thoracic Society. Because of the time limitations, my comments will highlight some of the brief points that are made in the written testimony that has already been submitted, and my concentration will be focused on the health effects primarily of sulfur dioxide, the predominate problems associated with the emissions we're discussing today.

During the past two decades, researchers have found harmful health effects occurring at lower and lower levels of air pollution. This trend is attributed to our growing ability to measure and understand air pollution and its effects.

Today's research findings contrast sharply with earlier reports. Journals today report effects on pulmonary functions from short-term exposure to sulfur dioxide at 0.1 parts per million, and to sulfuric acid at 100 micrograms per cubic meter of air, leaving little, if any, margin of safety for protecting sensitive individuals. Because these levels approach those that may occur in the ambient air, prudence dictates reexamination of control strategies for sulfur emissions from the burning of fossil fuels.

Sulfur is one of the most pervasive pollutants in the environment. In the United States, 30 million tons of sulfur oxides are emitted annually into the atmosphere by burning fossil fuels. And although federally mandated control programs have generally reduced sulfur dioxide levels over the past 10 to 15 years, concentrations of SO_2, sulfuric acid, and sulfates remain elevated in urban and nonurban areas of the country.

The health effects of these materials have focused, and the studies have focused, on the impact of sulfur pollutants on the clearance of foreign materials and infectious agents from the lungs, on respiratory function, on aggravation of lung and heart disease, and on mortality. And, I believe earlier, Mr. Sikorski mentioned the 50,000 added deaths, the estimates of added deaths, in this country annually that result from ambient air pollution.

Clinical studies with human subjects have increased our knowledge recently about the responses of both healthy and at risk individuals to short-term exposures of low levels of sulfur dioxide. The magnitude of the response varies depending on the individual sensitivity, the health status of the individual, and the activity level; whether the person is exercising or at rest.

In healthy subjects, respiratory and heart responses to sulfur dioxide have been consistently observed. Studies suggest that bronchial constriction, or narrowing of the breathing tubes in the lungs, generally occurs in healthy adults breathing sulfur dioxide concentrations of 1 to 2.5 parts per million; in addition, decreased pulmonary function has been observed in healthy subjects exposed to concentrations of SO_2 as low as 0.15 parts per million.

Of greater concern is the impact of SO_2 on individuals with hyperreactive airways; those particularly susceptible to airway-constriction patients with asthma, bronchitis, and emphysema. Such individuals are at particular risk to inhalation of ambient air pollutants.

In a systematic study of the effects of SO_2 on asthmatics, researchers observed bronchial constriction, wheezing, and shortness of breath at concentrations less than 0.5 parts per million, and in some asthmatics significant bronchial constriction occurs at levels as low as 0.1 parts per million.

Based on reported data, it appears that asthmatics are from between 7 to 22 times as sensitive to SO_2 as healthy subjects. Current research also demonstrates the effects of SO_2, in both healthy and asthmatic subjects, occur within a short period of time, within 10 to 30 minutes of exposure.

Basic to the intent of the Clean Air Act is the protection of all people; those including children chronically ill and the elderly and disabled individuals.

For this reason, air quality standards were set to provide an adequate margin of safety in the face of scientific uncertainties. For SO_2, the maximum 24-hour concentration, average concentration, is 0.14-parts-per-million, not to be exceeded more than 1 day per year; however, the 0.14-parts-per-million level does not reflect the most recent scientific information on concentrations of SO_2 at which adverse health consequences are observed.

In fact, the EPA has suggested the need for short-term SO_2 standards because the 24-hour standard may not protect individuals against these short-term health effects.

To further illustrate the problem, the 13 sulfur dioxide sampling stations in Indianapolis did not exceed the 24-hour standard of 0.14 parts per million in 1982, but all stations did exceed a 3-hour average concentration of 0.1 parts per million, and 1 hour averages of over 0.3 parts per million.

These data are summarized in a table which was recently presented to you for your information.

There are large numbers of people at risk for breathing the pollutants. These include those at highest risk; such as children, the elderly, and those who suffer from preexisting lung disease. In the latter group, there are over 16 million people in the United States that fall into that group.

In Indianapolis, 35 percent of the people are potentially at risk to adverse health effects because they also suffer from these diseases.

In conclusion, the adverse health consequences from low-level exposure to SO_2 by both healthy and high-risk individuals are now well documented and pose a significant public health problem.

The cost of medical care for people who suffer from diseases caused or aggravated by SO_2 and other pollution will be enormous and will contribute to the growing crisis in the United States in escalating health care costs, costs which directly effect businesses and corporations in the State of Indiana during this period of economic difficulty.

H.R. 3400 is a reasonable and sensible approach to reducing sulfur dioxide emissions to protect public health, sharing the costs of these reductions, and helping to ameliorate the crisis in health care costs that our country now faces.

Thank you, Mr. Chairman.

[Dr. Jay's prepared statement follows:]

Testimony before the U.S. House of Representatives Subcommittee on
Health and the Environment
presented by
Stephen J. Jay, M.D., American Lung Association of Indiana
Friday, February 10, 1984, 11:00 a.m.
Indianapolis Public Schools Education Center
120 East Walnut Street
Indianapolis, Indiana

The Adverse Health Effects of Sulfur Oxide Emissions

During the past two decades, researchers have found harmful health effects occuring at lower and lower levels of air pollution. This trend is attributed to our growing ability to measure and understand air pollution and its effects. Historically, the standards for safe amounts of sulfur oxides in the air were based primarily on the results of epidemiological studies. While controlled studies on humans showed some of the same kinds of health effects observed epidemiologically, the exposure levels required to evoke these responses were much higher. Today's research findings contrast sharply with these earlier controlled studies. Scientific journals report effects on pulmonary function from short-term exposure to sulfur dioxide at 0.10 parts per million and to sulfuric acid at 100 micrograms per cubic meter of air, leaving little, if any, margin of safety for protecting sensitive individuals. Because these levels approach those that may occur in the ambient air, prudence dictates reexamination of the control strategies for sulfur emissions from the burning of fossil fuels.

Sulfur is one of the most pervasive pollutants in the environment. In the United States alone, nearly 30 million tons of sulfur oxides, primarily sulfur dioxide, are emitted annually into the atmosphere by burning fossil fuels. Although Federally mandated control programs have generally reduced sulfur dioxide levels over the past 10 to 15 years, concentrations of this gas and associated sulfates remain elevated in some nonurban areas. This situation can only be worsened with the increasing burning of high-sulfur fuels. Moreover, some control schemes may have made matters worse. Noteworthy is the use of tall smokestacks, intended to improve local air quality, which have created problems with long-range transport of sulfur pollutants. Clearly, the emissions from sulfur-bearing compounds need to be controlled at their source more effectively in order to adequately protect the health of the public.

Health studies have focused on the impact of sulfur pollutants on the clearance of foreign matter from the respiratory tract and defenses against infectious agents, respiratory mechanics, aggravation of respiratory and cardiovascular disease, and mortality.

Clinical studies with human subjects have increased our knowledge about the responses of both healthy and special at-risk individuals to short-term exposures of low levels of sulfur dioxide. The magnitude of the response varies depending on individual sensitivity, health status, and activity level. In healthy subjects at rest, respiratory and cardiovascular responses have been consistently observed. The findings of several investigators suggest potentiation of sulfur dioxide airway effects with mouthbreathing and increased exercise levels, or both. Studies suggest bronchoconstriction generally occurs in healthy adults orally breathing sulfur dioxide concentrations of 1.0 to 2.5 parts per million.[1-3] In addition, pulmonary function effects have been observed in healthy subjects exposed to concentrations of sulfur dioxide as low as 0.15 parts per million.[4]

Of greater concern is the impact of sulfur dioxide on individuals with hyperreactive airways--those particularly susceptible to airway constriction. Such individuals include asthmatics and persons with disorders such as hay fever and other allergies.

In a systematic study of the effects of sulfur dioxide on asthmatics, researchers observed bronchoconstriction, sometimes with wheezing and shortness of breath, at concentrations less than 0.5 parts per million.[4,5,10] In some asthmatics, significant bronchoconstriction occurred at levels as low as 0.10-0.15 parts per million.[4,5] Based on reported data, it appears that asthmatics are from 7 to 22 times as sensitive to sulfur dioxide as healthy subjects.[7,8,9] Current research also demonstrates that the effects of exposure to sulfur dioxide in both healthy and asthmatic subjects occur within a very short time; that is, 10 to 30 minutes.[1,3,5,6,10]

Inhalation of sulfuric acid mist (0.35 to 5.0 milligrams per cubic meter of air) increases respiratory rate and decreases airflow rates and breathing volume, according to some studies with healthy adults.

In studies with asthmatic subjects, changes in airway function have been demonstrated after exposure to sulfuric acid at concentrations less than 1000 micrograms per cubic meter of air. At 500 micrograms per cubic meter of air and higher, reduction in airflow and the volume of air that can be exhaled have been observed in adult asthmatics after sulfuric acid exposures.[12] In a group of adolescent asthmatics exposed at rest for only one-half hour, followed by 10 minutes of moderate exercise, significant changes in pulmonary function occured with a sulfuric acid concentration of 100 micrograms per cubic meter of air.[13]

Basic to the intent of the Clean Air Act is the protection of the health of all people, including children, the chronically ill, and the elderly. For this reason, air quality standards were set to provide an adequate margin of safety in the face of scientific uncertainties. For sulfur dioxide, the maximum 24 hour average concentration is 0.14 parts per million, not to be exceeded more than one day per year. However, the 0.14 parts per million level does not reflect the most recent scientific information on the concentrations of sulfur dioxide at which adverse health consequences are observed. In fact, the EPA has suggested the need for a 1 hour sulfur dioxide standard because the 24 hour standard may not protect individuals against short-term health effects.[14]

To further illustrate this problem, the 13 sulfur dioxide sampling stations in Indianapolis did not exceed the 24 hour standard of 0.14 parts per million in 1982. But, all stations did exceed a 3 hour average concentration of 0.10 parts per million, and 1 hour averages of over 0.30 parts per million were measured. Clearly, based on the most recent scientific evidence, measured sulfur dioxide concentrations in Indianapolis may pose public health risks.[15]

Currently, no standards have been set for ambient sulfuric acid or sulfate aerosols.

Large numbers of people are at risk for the health effects of sulfur dioxide. Children are one of the groups at risk. In the U.S. there are approximately 62.5 million children under 17 years of age and 46.3 million under 14 years of age. In pre-pubescent children the lung and immune system are immature and thus offer incomplete protection from exposure to sulfur oxide gases and other pollutants. In addition, because children spend more time outdoors and are more active than adults, they have greater exposure to ambient air pollutants and, probably, experience greater doses because of higher ventilation rates from increased activity.[16-23]

Another high risk group is the elderly, and there are approximately 24.6 million people 65 years of age or older. In addition to immunulogical deficiences, many elderly have reduced lung elasticity, and all elderly have lost some lung function, making them more susceptible to elevated levels of these air pollutants.[23-25]

Finally, over 16 million people suffer from chronic bronchitis, emphysema, and asthma.[26]

In Indianapolis, there are about 169,000 children less than 14 years of age; about 12,000 of these have asthma. There are 76,000 people over age 65. And, there are an estimated 20,000 adults who suffer from asthma, chronic bronchitis, and emphysema.[27,30] This means that approximately 35% of the people in Indianapolis are potentially at risk to adverse health effects of sulfur dioxide exposure.

These individuals have the right to be protected against the harmful effects of all air pollutants and the right to breathe clean air. Respect of these rights dictates that emissions of harmful pollutants such as sulfur dioxide be decreased below existing levels.

Concern over these reductions in Indiana has understandably focused on the economics of controlling sulfur dioxide. Indiana is one of the nation's largest generators of sulfur dioxide, high sulfur coal is mined and burned here, and the state has been implicated as a major contributor to acid rain. There is no question that reduction of sulfur dioxide emissions will cost money. It will also cost billions of dollars to provide medical care to the people who suffer from diseases caused or aggravated by this pollution. An American Lung Association survey of 23 studies published between 1967 and 1977 on the health costs of air pollution found that the annual damages to health from air pollution ranged from $.58 billion to $16.6 billion.[29] All of these costs will be shared by everyone. But by making the investment to clean the air now, the enormous costs for health care, as well as the cost in human suffering, can be greatly reduced in the future. For example, in 1978, the Council on Environmental Quality estimated that a 20 percent reduction in ambient concentrations of sulfur dioxide and particulates from 1970-78 resulted in a savings of $17 billion each year in health care costs.[28]

In conclusion, the adverse health consequences from low level exposure to sulfur dioxides by both healthy and high risk individuals are well documented and pose a significant public health problem. The cost of medical care for people who suffer from diseases caused or aggravated by sulfur dioxide and other air pollution will be enormous and will contribute to the growing crisis the United States faces in escalating health care costs. H.R. 3400 is a sensible and reasonable approach to reducing sulfur dioxide emissions to protect public health, sharing the costs of these reductions, and helping to ameliorate the crisis in health care costs that our country faces.

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Mr. WAXMAN. Thank you very much, Dr. Jay, for that presentation to us.

I'd like to call on Mr. Widlak next. We are pleased to have you with us.

STATEMENT OF FREDERIC W. WIDLAK, PH.D.

Dr. WIDLAK. Thank you Mr. Chairman and members of the subcommittee. My name is Fred Widlak and I am a member and former chairman of the national executive board of the Izaak Walton League of America.

By occupation I am an administrator of research and evaluation for the Marion County Health Department in Indianapolis.

However, my remarks today should not be construed to represent the official position of that organization.

Today I am speaking on behalf of the Indiana clean air coalition, a consortium of individuals and citizen-based groups concerned about air quality in our State.

A list of these groups is the first attachment to my written testimony. Our combined membership represents over 20,000 Hoosiers from Lake Michigan to the Ohio River.

Since my presentation time is limited, I shall rapidly highlight our major points of concern and refer to the documents appended to my written statement.

The first point I wish to make is that Indiana is both a major source and a major recipient of acid rain. Although most of the publicity about the impact of acid precipitation has been focused on the slow deaths of lakes in Canada and Northeastern United States, the Midwest is also suffering from this chemical fallout.

Dr. Richard Miller's overview of "Indiana and Acid Rain" indicates that, because of the alkaline nature of our soils, our lakes and streams have substantial buffering capacity for the acid and thus have not yet shown the die-off of fish and other aquatic life that has occurred in Ontario and the Adirondacks.

The tables you have there indicate that Indiana utilities ranked fifth among the Eastern States in fossil fuel consumed during the year 1980, but ranked second in total SO_2 emissions and second in the rate of sulfur dioxide emitted per unit of energy.

The three maps of the Eastern United States show the highest concentrations of airborne sulfur dioxide and sulfates to follow the course of the Ohio River from southern Indiana to western Pennsylvania upstream.

This area also contains the most closely packed chain of coal-fired powerplants in the country. The map of the average rainfall pH contours for 1980 shows the most acidic precipitation from Illinois in the West to New England in the East, and from Kentucky in the South, to Quebec in the North.

The table of pH values of the weekly precipitation samples collected at the Indiana Dunes National Lakeshore shows that Northern Indiana's rainfall pH averages 4.36. This is about 20 times more acidic than a normal rainfall pH value of 5.6.

In looking at the changes in each State's SO_2 emissions over the recent past, I'm referring to a document that I did not get in time to include in your packet. This is from the Peckan & Associates study of 1982 for U.S. EPA.

It indicates that, looking at our neighboring States and the changes in SO_2 emissions from the years 1976 to 1980, Illinois' SO_2 emissions declined 21 percent; Kentucky's went down 33 percent; Michigan's decreased 36 percent; and Ohio's went down 21 percent.

However, Indiana's went up 7 percent. So, out of this group in the Ohio River Valley and our immediate neighbors, Indiana was the only State to actually increase SO_2 emissions over that 4-year period.

The more detailed maps from the 1983 National Academy of Sciences report substantiates the claim that Indiana is both a major producer and receptor of acid-forming atmospheric deposition.

These local effects take the form of reduced visibility because of acid haze; damage to foliage including crops, forests, and horticultural vegetation; and the erosion of buildings and monuments in Indianapolis. The documentation is in the packet you have documentation there.

I have just received word of a study done by the System Application Corp. for EPA that evaluates the air quality improvements in Indiana, which would take place under H.R. 3400.

Looking in particular at the visibility improvement, we see a 12-percent improvement with an economic value of more than $65 million. So, it's a substantial visibility improvement that we're looking at. This study will soon be available to you from EPA.

In looking in particular at the forestry problems, another document that just came into my hands was one produced by the German Forestry Journal and I have obtained copies and have deposited them with the staff here so that you'll be getting copies.

It is a full color pamphlet indicating the different kinds of forestry damage that they've been experiencing over in Germany due to acid rain. The kinds of tree damage that the Germans are seeing is very similar to what we're seeing in the United States. So, we're getting more and more documentation to show that, like Europe, we are suffering in our forestry resource from acid rain.

My other documentation in the packet includes information about the difference in electric rates resulting from SO_2 control. We support the contention that the rate of increase is probably more on the scale of 10 to 13 percent due to acid rain control expenses. This is about one-third of the rate increase that our local utilities have been unjustifiably proclaiming.

In polls of the American public, we see that Lou Harris' poll shows that 70 percent of the people polled are willing to pay an extra $100 a year, in addition to higher utility rates, to pay for cleanup.

We have results of polls taken by local TV stations and newspapers that indicate that here, in Indianapolis, people are willing to pay the cost for acid rain cleanup.

So, I will thus refer you to the other materials that I have prepared. I'll be glad to answer questions to deal with any of those materials in detail.

I want to add that I just received news that the Chambers of Commerce of the United States and Canada have completed a joint resolution for sulfur dioxide reduction.

This is an important first step when these major bodies concerned about the economic future of both our countries can agree that SO_2 must be reduced.

Thank you.

[Statement of Dr. Widlak follows:]

Clean Air
CAMPAIGN

Testimony of
Frederic W. Widlak, Ph.D.
Indiana Division
of the
Izaak Walton League of America
on behalf of the
Indiana Clean Air Coalition
before the
United States House of Representatives
Subcommittee on Health and the Environment
of the
Energy and Commerce Committee
on the
National Acid Deposition Control Act of 1983 (H.R. 3400)
Indianapolis, Indiana
February 10, 1983

INDIANA CLEAN AIR COALITION

Clean Air
CAMPAIGN

Mr. Chairman and members of the subcommittee, my name is Fred Widlak and I am a member and former Chairman of the National Executive Board of the Izaak Walton League of America. By occupation I am an Administrator of Research and Evaluation for the Marion County Health Department in Indianapolis. However, my remarks should not be construed to represent the official position of my employer. Today I am speaking on behalf of the Indiana Clean Air Coalition, a consortium of individuals and citizen-based groups concerned about air quality in our state. A list of the principal groups in the coalition is the first attachment to my written testimony. Our combined membership represents over 20,000 Hoosiers from Lake Michigan to the Ohio River.

Since my presentation time is limited, I shall rapidly highlight our major points of concern and refer to the documents appended to my written statement. The first point I wish to make is that Indiana is both a major source and a major recipient of acid rain. Although most of the publicity about the impact of acid precipitation has been focussed on the slow death of lakes in Canada and the Northeastern United States, the Midwest is also suffering from this chemical fallout. Dr. Richard W. Miller's overview of "Indiana and Acid Rain" indicates that because of the alkaline nature of our soils, our lakes and streams have substantial buffering capacity for acid and this have not yet shown the dieoff of fish and other aquatic life that has occurred in Ontario and the Adirondacks.

The table labelled BB-2 shows that Indiana utilities ranked fifth among the Eastern states in fossil fuel consumed during the year 1980, but ranked second in the rate of sulfur dioxide emitted per unit of energy. The three maps of the Eastern United States show the highest concentrations of airborne sulfur dioxide and sulfates to follow the course of the Ohio River from Southern Indiana to Western Pennsylvania. This area also contains the most closely-packed chain of coal-fired power plants in the country. The map of average rainfall pH contours for fiscal year 1980 shows the most acidic precipitation from Illinois on the Western edge to New England and from Kentucky in the South to Quebec. The table of pH values of weekly precipitation samples collected at the Indiana Dunes National Lakeshore shows that Northern Indiana's rainfall ph averages 4.36 -- 20 times more acidic than a "normal" value of 5.6.

The more detailed maps from the 1983 National Academy of Sciences report substantiates the claim that Indiana is both a major producer and receptor of acid-forming atmospheric deposition. The local effects take the form of reduced visibility because of "acid haze", damage to foliage, including crops, forests, and horticultural vegetation, and to the erosion of buildings and monuments in Indianapolis. The dollar value of the deterioration of historic limestone landmarks here is difficult to estimate, but the whole nation's building repair bill due to acid rain is likely to be billions of dollars. The combination of high concentrations of sulfur dioxide and ozone with stagnant summer weather patterns makes Indiana's melon and soybean crops especially susceptible to direct biological damage and to insect infestation. Dr. Orie Loucks of Bulter University's Holcomb Research Institute estimates that air pollution cut's Indiana's agricultural production by $100 million each year.

According to the Congressional Office of Technology Assessment, the Midwestern states now enjoy electricity rates that are 33 percent lower than their Northeast neighbors. In 1982, the average monthly Indiana electric bill was approximately $42.66. Under the Waxman-Sikorski bill (H.R. 3400), this rate is projected to increase by between 10 to 13 percent by the year 1995 due to acid rain control expenses. This is about one-third of the amount of rate increase that our local electric utilities have been unjustifiably proclaiming.

We believe that Hoosiers are willing to pay these additional charges to help control acid rain. These are strong indications that other areas of the country are willing to do the same. For example, a recent poll conducted by Louis Harris and Associates found the 70 percent of the people polled were willing to pay an extra $100 a year - in addition to higher utility rates - in order to clean up water pollution and control acid rain. This committment to help pay for environmental clean-up is far above that required under the Waxman-Sikorski bill (H.R. 3400). Locally, station WTHR-TV took a viewer phone-in poll in July, 1983 asking the question "Do you think Midwest utility customers should pay for acid rain clean-up?" The responses were 67 percent "yes". The Indianapolis News took a phone-in poll of its readers at the same time, asking "Are you concerned about acid rain?" The results were: "Yes" - 65 and "No" - 17.

The Indiana Clean Air Coalition believes that the Waxman-Sikorski bill is the best legislative vehicle that would reduce the sulfur emissions that cause acid rain while also preserving coal mining jobs in the state of Indiana.

According to forecasts by ICF, a respected consulting firm, the 1980 level of coal production in Indiana of 30.9 million tons of coal is slated to increase 36 percent by 1995 under acid rain control legislation similar to the Waxman-Sikorski bill (H.R. 3400). This translates into an employment level of about 10,000 persons working in the coal mining industry in 1995. The single factor which will probably be the most important determinant of United Mine Workers employment is the rate of depletion of the oldest miners.

The various strategies for reducing acid deposition in the United States have undergone a very thorough analysis, as shown in the article by Streets, Knudson, and Shannon. When considering the costs and benefits of the alternative control strategies presented, the provisions of the Waxman-Sikorski bill (H.R. 3400) appear to be most favorable to Indiana's economy.

We agree with Kevin Greene's solution for reconciling the Midwest's needs for a healthy economy and a healthy environment. His recommendations of focussing on the largest emitters, installing pollution control equipment rather than fuel-switching, easing financial burdens, and using uncontrolled power plants last, are exemplified in the Waxman-Sikorski bill (H.R. 3400) which promotes the clean burning of high-sulfur coal. The traditional methods of coal washing and flue gas desulfurization via scrubbers could soon become obsolete if technological advances such as the dry-scrubbing process prove cost-effective. We are encouraged by the plans of Indianapolis Power and Light Company to test the electron beam radiation process. We hope that other utilities and manufacturers will seek ways to burn Indiana coal cleanly.

The Indiana Clean Air Coalition strongly believes that acid rain can and must be controlled. We agree with the recommendation of the National Academy of Sciences that a fifty percent reduction in sulfur emissions is necessary to protect sensitive natural resources. We urge the members of this subcommittee to support and cosponsor the Waxman-Sikorski bill (H.R. 3400) and to support strengthening amendments that would result in a net reduction of at least ten million tons of sulfur emissions over a ten year period.

We completely disagree with the go-slow recommendations of the Hudson Institute report to the Hoosiers for Economic Development Committee. That report did not consider the strategy inherent in the Waxman-Sikorski bill (H.R. 3400) and failed to appropriately weigh the most significant scientific evidence favoring acid rain control. A survey of scientists by the National Wildlife Federation shows that acid precipitation researchers responded by a 7 to 1 margin in favor of starting an acid rain control program now rather than postponing action until more research is done.

I appreciate the opportunity to present our views before this subcommittee and would be glad to answer any questions at this time.

The Indiana Clean Air Coalition is made up of the following organizations:

- American Lung Association
- Environmental Action
- Friends of the Earth
- Hike, Bike, and Bus Week Committee
- Izaak Walton League
- League of Women Voters
- National Audubon Society
- National Wildlife Federation
- Save the Dunes Council
- Save the Valley
- Sierra Club
- United Steelworkers of America
- Valley Watch

Plus a network of individuals and local organizations concerned with the environment, health, labor, parks and other resources threatened by air pollution.

INDIANA AND ACID RAIN

Summary of Remarks at a Symposium,

Jobs and a Clean Environment for Indiana
March 5, 1983

Richard W. Miller
Dept. of Zoology, Butler University

The phenomenon of "acid rain" includes the wet and dry deposition of acid and acid-forming chemicals from the atmosphere. Because of the economic impacts of acid rain, both the adverse environmental effects and the cost of regulation, the scientific questions of cause and effect have become part of a larger political debate. The following statements, based on personal experience and analysis of the literature, represent the current scientific understanding of acid rain. They are meant to provide a foundation for future discussion.

1) Acid precipitation is occurring in the eastern U.S. and Canada, parts of the western U.S. and in Europe.
2) The major acidifying chemicals in the atmosphere are oxides of sulfur and nitrogen,
3) Utilities contribute 71% of total man-made sulfur dioxide and about one-third of man-made nitrogen oxides in the eastern U.S. Other emission sources include fossil fuel combustion in transportation, industry and residential and commercial uses. Natural sulfur sources are not important when discussing "acid rain" in the eastern U.S.
4) The sources of the acid rain deposited in a particular area can be roughly estimated by region. Identification of individual sources is not possible.
5) Surface water chemistry and fisheries have been altered in poorly-buffered regions.
6) Effects on crops and forests are possible, but information to demonstrate these effects is meager. Forests are more likely to be affected than agricultural crops.
7) Material corrosion effects are well-known but result from a combination of air pollutants.

These statements can be used to focus attention on Indiana and its role as a source and recipient of acid rain. Wet precipitation in Indiana is consistently at least ten times more acid than hypothetical "clean" rain. Because of the predominantly limestone geology of the state, which provides an excellent buffer of incoming acid, aquatic effects of acid rain are not expected and have not been found. Effects on crops and forests remain a possibility. However, plants in Indiana are subject to damage from a variety of air pollutants, and identifying an acid rain damage component will be difficult or impossible. The most likely effect of acid rain in Indiana is corrosion of marble, limestone and other structures, but this has not been quantified.

As a source of sulfur and nitrogen oxides, the precursors of acid rain, Indiana is third in emissions of SO_2 and fifth in emissions of NO_x among the 31 states of the eastern U.S. About 74% of SO_2 emissions in Indiana come from utilities, and Indiana utilities have the second highest emission rate for SO_2 in the eastern U.S. Overall, Indiana is the source of about 9% of SO_2 and about 5.5% of NO_x

emissions in the eastern U.S. These figures are based on emissions in 1980; recent actions by the state government may have the effect of increasing emissions even further.

The fate of sulfur and nitrogen oxide emissions from Indiana is open to dispute but can be assessed in an approximate way. One possible method is a trajectory model, which uses meteorological data to trace backward from a particular location to find the origin of the air mass over that location. A trajectory model developed at the University of Michigan, utilizing a linear sulfur transformation process, calculates that about 5% of the sulfate in wet deposition in the Adirondacks comes from Indiana.

Examination of this and other atmospheric transport models quickly leads to the conclusion that acid rain is not properly thought of as a source vs. receptor situation. Rather, the entire eastern U.S. can be considered as an overlapping mixture of sources and receptors. Indiana receives acid rain from various upwind sources and is, in turn, a source of acid rain at various downwind locations. The solution to this problem will not come from a series of "us vs. them" confrontations but from cooperation among all states in the region. The current Clean Air Act, with its emphasis on local pollutants and State Implementation Plans does not encourage cooperation among the states. A revised Clean Air Act should recognize the existence of regional air pollution problems, such as acid rain and ozone, and encourage states to join together in solving them. In Indiana, we have a lot to gain by such an approach.

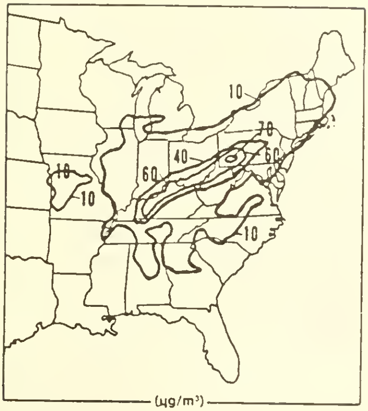
TABLE BB-2

EMISSIONS, FOSSIL FUEL CONSUMPTION, AND EMISSION RATES
FOR UTILITIES IN THE EASTERN U.S., 1980

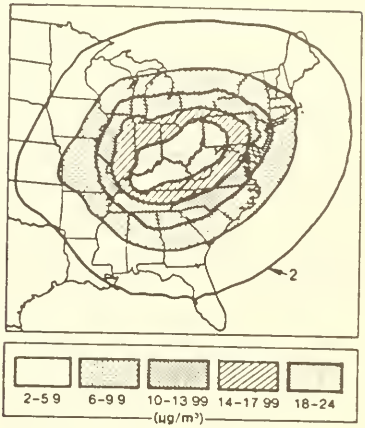
	SO$_2$ Emissions (1000 tons)	Rank	Fossil Fuel Consumed (10^{12} Btu)	Rank	Emission Rate (lb SO$_2$/ mm Btus)	Rank
Alabama	563.7	12	472.9	15	2.3	12
Arkansas	26.5	27	111.1	26	0.5	30
Connecticut	32.2	26	133.2	25	0.5	30
Delaware	52.5	25	71.2	27	1.5	19
District of Columbia	4.6	31	9.5	30	1.0	27
Florida	725.8	10	836.6	3	1.7	18
Georgia	726.3	9	513.6	11	2.9	7
Illinois	1,127.5	5	820.5	4	2.7	9
→ Indiana	1,536.5	2	733.9	5	4.2	2
Iowa	232.4	17	210.6	22	2.2	13
Kentucky	983.1	8	561.2	10	3.6	5
Louisiana	25.0	28	489.7	14	0.1	21
Maine	16.3	29	23.0	29	1.4	22
Maryland	223.2	18	206.2	23	2.1	14
Massachusetts	275.5	16	313.6	16	1.8	16
Michigan	565.4	11	614.2	8	1.8	16
Minnesota	180.2	20	234.8	20	1.5	19
Mississippi	132.2	22	199.2	24	1.3	25
Missouri	1,139.7	4	512.0	12	4.5	1
New Hampshire	80.3	24	56.2	28	2.9	7
New Jersey	110.2	23	244.1	18	0.9	29
New York	488.5	13	685.8	7	1.4	22
North Carolina	435.8	15	592.2	9	1.5	19
Ohio	2,168.7	1	1,128.1	2	3.8	3
Pennsylvania	1,441.8	3	1,149.9	1	2.5	11
Rhode Island	5.2	30	10.5	31	1.0	27
South Carolina	219.6	19	219.0	21	1.9	15
Tennessee	933.7	7	506.5	13	3.7	4
Vermont	0.4	32	0.6	32	1.2	26
Virginia	163.2	21	238.1	19	1.4	22
West Virginia	947.1	6	695.8	6	2.7	9
Wisconsin	448.3	14	286.1	17	3.4	6
ARMS Region Total	16,011.4		12,852.9		2.5	

Source: E. H. Pechan & Associates, 1982.

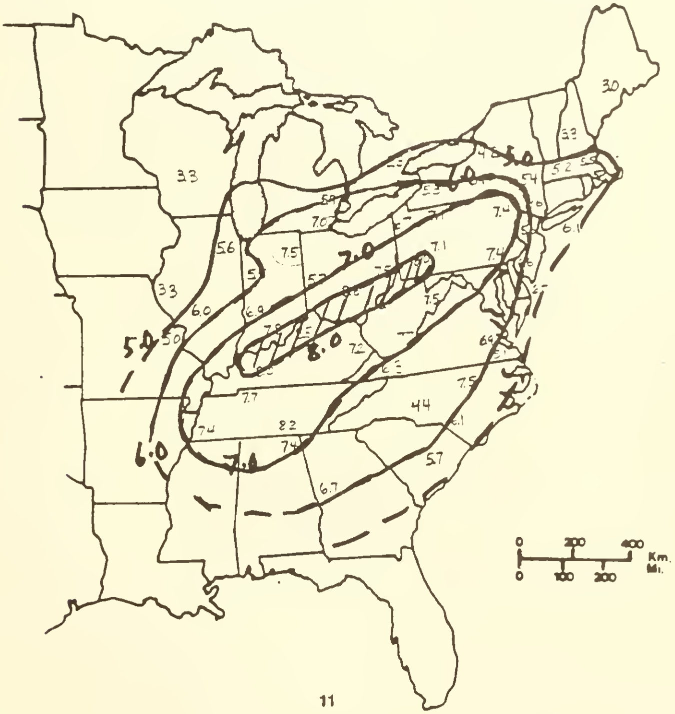
Sulfur Dioxide Concentrations
August 27, 1974



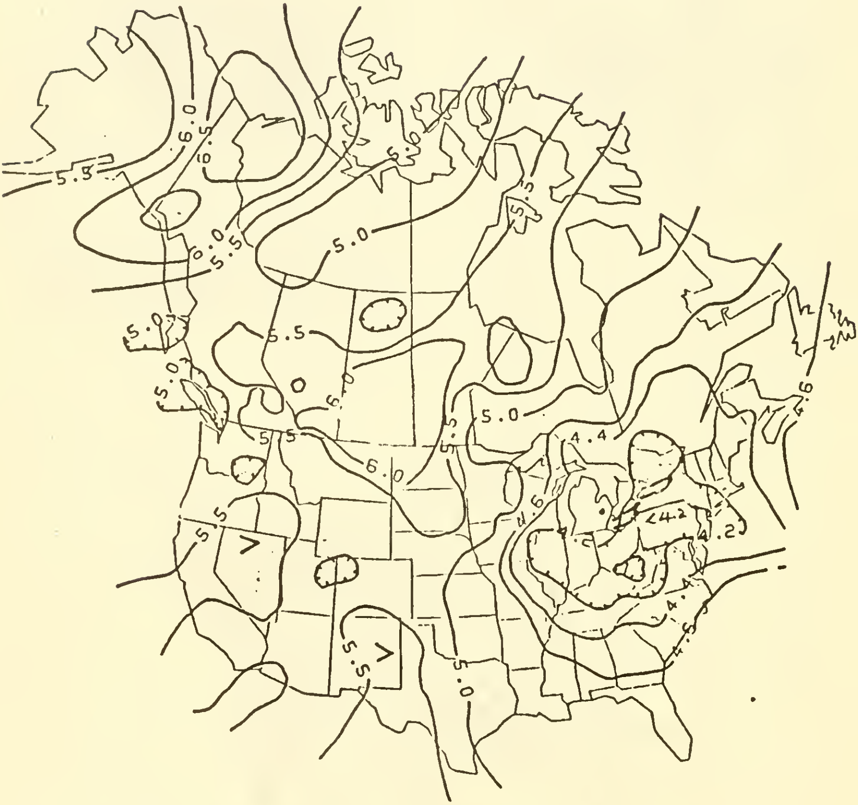
Annual Average Sulfur Dioxide
Concentrations



"Annual Average" sulfate concentrations ($\mu g/m^3$) in the eastern U.S.



Distribution of the average annual pH of rainfall in the United States and Canada.



NATIONAL ATMOSPHERIC DEPOSITION PROGRAM - NC141
pH Annual Average
Sept '79 - Oct '80
Precipitation - weighted
NADP & CANSAP DATA

Bailly Ranger Station
Indiana Dunes National Lakeshor

Acid Rain Summary 1983.

(CUMULATIVE WEEKLY SAMPLES)

Week of	pH	Week of	pH
1/4	—	7/5	4.28
1/11	485	7/12	420
1/18	4.49	7/19	4.42
1/25	5.28	7/26	4.17
2/1	4.48	8/2	
2/8	—	8/9	449
2/15	—	8/16	4.19
2/22	(HIGHEST) 5.38	8/23	382
3/1	4.59	8/30	415
3/8	4.70	9/6	3.98
3/15	430	9/13	3.80
3/22	4.29	9/20	4.10
3/29	4.30	9/27	—
4/5	4.18	10/4	498
4/12	4.41	10/11	452
4/19	—	10/18	—
4/26	4.52	10/25	—
5/3	447	11/1	—
5/10	4.13	11/8	(LOWEST) 3.60
5/17	4.79	11/15	3.81
5/24	4.91	11/22	4.09
5/31	4.20	11/29	4.05
6/7	—	12/6	4.10
6/14	4.13	12/13	3.89
6/21	4.33	12/20	4.39
6/28	4.50	12/27	4.31

AVG. = 4.36

ACID DEPOSITION
Atmospheric Processes in Eastern North America
A Review of Current Scientific Understanding

Committee on Atmospheric Transport and Chemical Transformation in Acid Precipitation

Environmental Studies Board

Commission on Physical Sciences,
Mathematics, and Resources

National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1983

Introduction

During the past 25 years in Europe and the past 10 years in North America, scientific evidence has accumulated suggesting that air pollution resulting from emissions of hydrocarbons and oxides of sulfur and nitrogen may have significant adverse effects on ecosystems even when the pollutants or their reaction products are deposited from the air in locations remote from the major sources of the pollution (National Research Council 1981, Environment '82 Committee 1982). Some constituents of air pollution are acids or become acidic when they reach the Earth's surface and interact with water, soil, or plant life. Several studies have documented the potentially harmful effects of the deposition of acids on ecosystems (NRC 1981, National Research Council of Canada 1981, Overrein et al. 1980, Drablos and Tollen 1980). Although the pollutants may be deposited in dry form or in rain, snow, or fog, the deposition phenomenon is often called acid rain or acid precipitation. In this report we use the term acid deposition to encompass both wet and dry processes.

DEPOSITION ACIDITY

An acid is a chemical substance that, in water, provides an excess of hydrogen ions (H^+) to the solution.[1] In solutions, the electrical charges of positively charged ions (cations) balance those of negatively charged ions (anions). In acid precipitation, excess hydrogen ions are usually balanced by sulfate ($SO_4^=$), nitrate (NO_3^-), and to a lesser extent chloride (Cl^-) ions. There may, in general, be other cations in addition to H^+ present in precipitation. Organic acids, for example, are found in all areas, but they are important as donors of hydrogen ions only in remote areas where concentrations of sulfate and nitrate are lower (Galloway et al. 1982). Acid deposition in dry form consists of gases such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), and nitric acid vapor (HNO_3) as well as particles containing sulfates, nitrates, and chlorides.

Acids occur naturally in the atmosphere because, for example, of the dissolution of carbon dioxide (CO_2) in water or the oxidation of naturally occurring compounds of sulfur and nitrogen. The "natural" acidity of rainwater, measured as pH,[2] is often assumed to be pH 5.6, which is an idealized value calculated for pure water in equilibrium with atmospheric concentrations of CO_2. However, the presence of other naturally occurring species, such as SO_2, ammonia, organic compounds, and windblown dust, can lead to "natural" values of pH between 4.9 and 6.5 (Charlson and Rodhe 1982, Galloway et al. 1982).

The presence of compounds of sulfur and nitrogen of anthropogenic origin tends to increase the acidity (lower the pH) of precipitation. More than half the acidity of precipitation averaged over the globe may be due to natural sources, but anthropogenic sources may dominate in some regions. For example, in eastern North America (i.e., east of the Mississippi River) 90 to 95 percent of precipitation acidity may be the result of human activities, although natural sources may also be important at times in specific locations (U.S./Canada Work Group #2 1982).

Figure 1.1 shows the mean value of pH in precipitation weighted by the amount of precipitation in the United States and Canada in 1980. There are no known natural causes that can account for either the distribution or the value of acidity in eastern North America. The region of highest acidity does, however, correspond to the regions of heavy industrialization and urbanization along the Ohio River Valley and the Eastern Seaboard, where anthropogenic emissions of sulfur dioxide (Figure 1.2), nitrogen oxides (Figure 1.3), and hydrocarbons are high. Figures 1.4 and 1.5 indicate the spatial distributions of sulfate and nitrate, respectively, weighted by the amount of precipitation that was deposited in North America in 1980. The data were obtained from several monitoring networks in the United States and Canada.

Trends in acid deposition in North America have been difficult to discern, and data with which to assess them are sparse. Comparisons of historical data (for example, Cogbill and Likens 1974) have been questioned because of

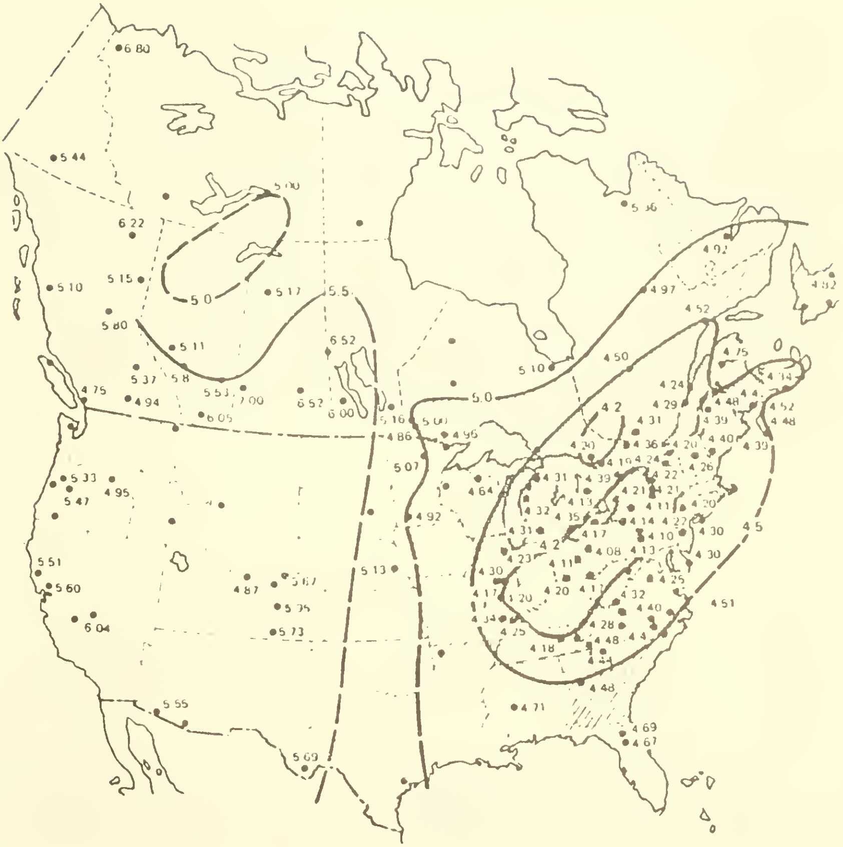


FIGURE 1.1 Annual mean value of pH in precipitation weighted by the amount of precipitation in the United States and Canada for 1980. SOURCE: U.S./Canada Work Group #2 (1982).

difficulties associated with comparing data obtained by means of different experimental methods of uncertain comparability at different sites at different times and because of difficulties in taking into account the influence of neutralizing substances on the data (Hanson and Hidy 1982, Stensland and Semonin 1982). A long-term (18-year) record of reasonably reliable data on deposition chemistry is available at only one site in North America (see Chapter 4).

The relationship between emissions and deposition in North America is complicated by changes that are not reflected in data on aggregate emissions. For example, because of concern about urban air pollution in the 1960s, there has been a tendency since then to build large new facilities away from urban centers and to use tall stacks to eject emissions at higher altitudes, hence promoting dispersal and dilution of the pollutants. Pollution control equipment installed during this period also changed the chemical and physical characteristics of the emissions, substantially reducing direct emissions of sulfates and neutralizing substances in fly ash. Thus, while total emissions of SO_2 in the United States increased between 1960 and 1970, urban concentrations of SO_2 decreased (Altshuller 1980). Almost all available data on air quality reflect urban conditions. Only recently have extensive networks of monitors been established in rural areas.

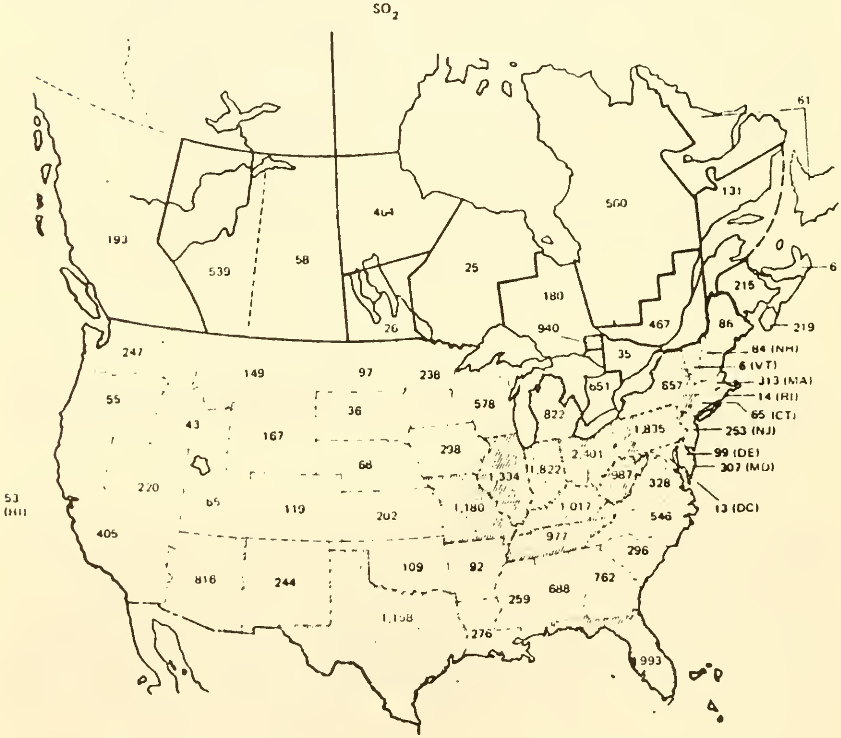


FIGURE 1.2 Representative values of SO_2 emissions in the United States and Canada in 1980 (thousands of metric tonnes). SOURCE: U.S./Canada Work Group #3B (1982).

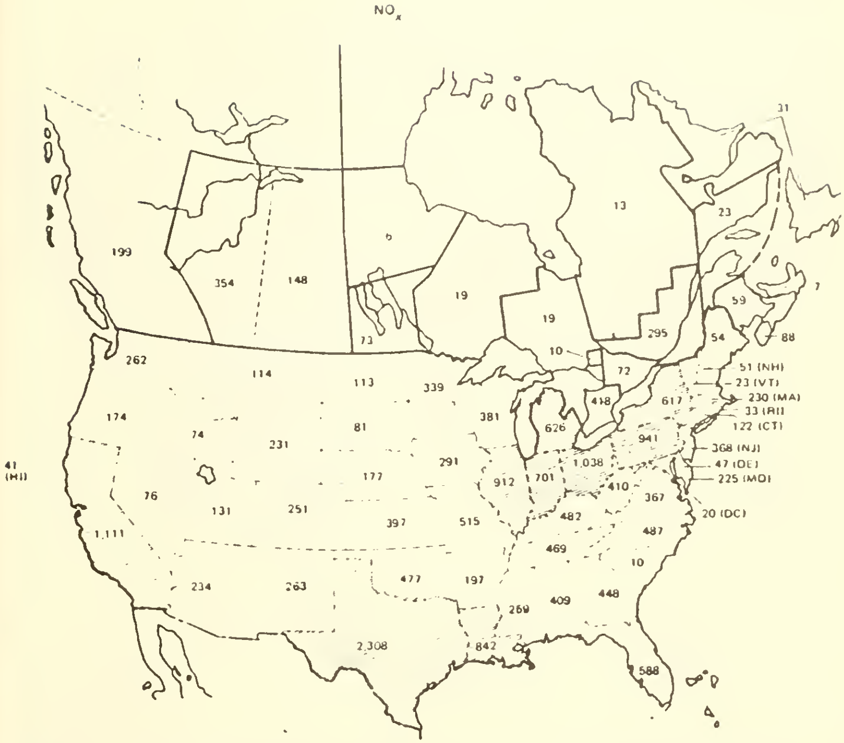
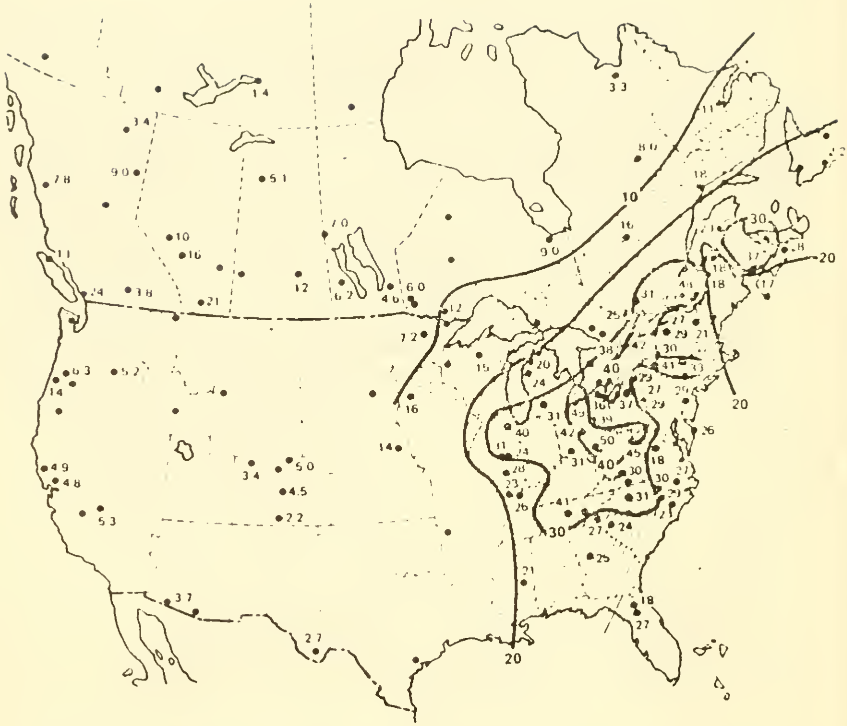


FIGURE 1.3 Representative values of NO$_x$ emmissions in the United States and Canada in 1980 (thousands of metric tonnes). SOURCE: U.S./Canada Work Group #3B (1982).

ENVIRONMENTAL EFFECTS

Atmospheric deposition involves three components: emissions, deposition, and effects on receptors. Certain aspects of the effects of atmospheric deposition are of particular importance for the development of effective policies for emission control. They concern the significance for receptors of (1) physical and chemical states of deposited materials and (2) rates and reversibility of acidification.

In discussing these issues, it is helpful to distinguish between primary, secondary, and tertiary receptors according to their proximity to the initially deposited material. Primary receptors experience direct contact with atmospheric pollutants. Examples are the surfaces of



1 m mole/m^2 = 0.961 kg/ha

FIGURE 1.4 Spatial distribution of mean annual wet deposition of sulfate weighted by the amount of precipitation in North America in 1980 (mmoles/m^2). SOURCE: U.S./Canada Work Group #2 (1982).

structures and materials, the outer foliage of vegetative canopies, and the surfaces of soils that are not protected by vegetative canopies. Secondary receptors are subject to wet and dry deposition indirectly and only after the pollutants have been in contact with other materials. Examples include the inner foliage of vegetative canopies, soil underneath vegetation, and subsurface layers of exposed soils. Tertiary receptors are even further removed from the point of initial contact with deposition. Examples are subsoil, underlying rock formations, streams and lakes that receive most of their water from runoff from the watershed, and lake and stream sediments. The rates of transfer and mixing of materials are affected by the proximity of the receptors to the point of initial deposition and by their mass and other physical and chemical properties.

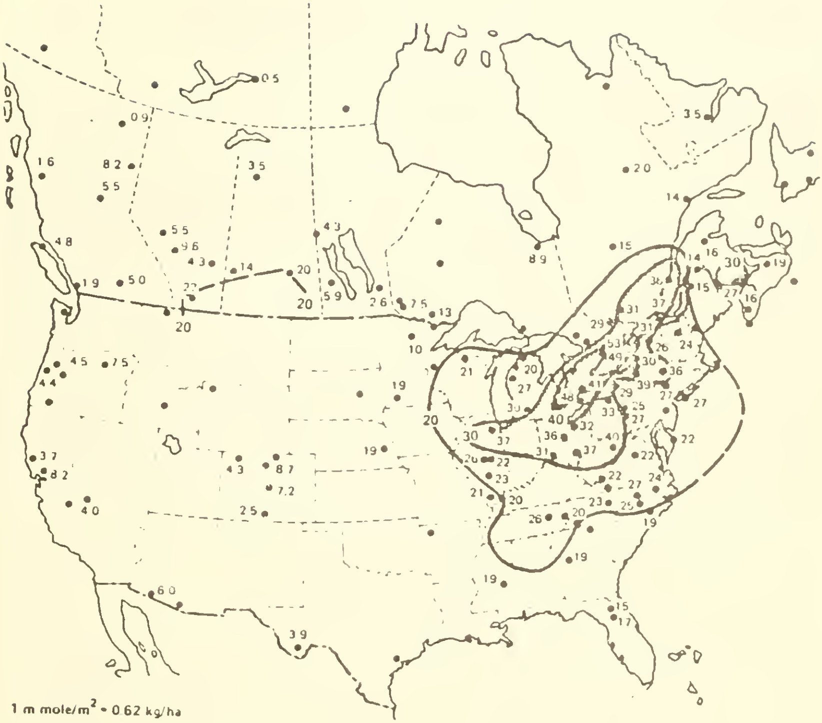


FIGURE 1.5 Spatial distribution of mean annual wet deposition of nitrate weighted by the amount of precipitation in North America in 1980 (mmoles/m^2). SOURCE: U.S./Canada Work Group #2 (1982).

Physical and Chemical States of Deposited Materials

The effects of atmospheric deposition on primary receptors depend on the physical state (solid, liquid, or gaseous) and the chemical state (e.g., sulfur or nitrogen species) of the deposited materials (NRC 1981). The physical form of deposited material determines its availability for reaction, whereas its chemical form determines its reactivity. Tertiary receptors are less responsive to the physical and chemical form of atmospheric deposition than primary and secondary receptors because of dilution. The effects of acid and acidifying ions (hydrogen, sulfate, nitrate, and ammonium) are dependent in part on the accompanying rates of deposition of neutralizing cations (calcium). Hydrogen ions are harmful to the extent that the receptors cannot prevent or compensate for changes in acidity or the consequences of acidification.

Many chemical compounds of both sulfur and nitrogen are naturally present in soils and are involved in chemical and biological transformations in soils and vegetation. Sulfur and nitrogen are essential nutrients required for plant growth. There are many differences in the properties and biological action of the compounds of the two elements, and there are differences in the types of transformations they undergo in the environment. Biological processes (e.g., metabolic action, decomposition) have a great influence on nitrogen transformations, while both geological processes (e.g., weathering) and microbial transformations strongly affect the sulfur cycle. There is a larger pool of endogenous nitrogen than of sulfur in organisms, and larger amounts of nitrogen than sulfur are required for plant growth. The two nutrients are closely related, so that addition of one element to an ecosystem allows greater biological utilization of the other (Turner and Lambert 1980). The optimum molar ratio of sulfur to nitrogen in terrestrial ecosystems is approximately 0.03.

Nitrogen usually is efficiently metabolized in undisturbed ecosystems (Likens et al. 1977), while sulfur frequently is not retained by forest soils (Abrahamsen 1980). For aquatic ecosystems, therefore, sulfur is more important for acidification than nitrogen. Alkaline as well as acidic cations accompany the movement of sulfate from soils to aquatic systems; consequently, acidification of soil is more likely to occur from excessive sulfate deposition than from excessive nitrate deposition. The spring flush of acids into aquatic systems may, however, be closely associated with the accumulation of nitrate and sulfate in snowpack (Galloway and Dillon 1982, McLean 1981).

One of the important effects of acidification is the potential mobilization of elements from soils due to increased solubility and subsequent uptake by vegetation or movement to aquatic systems. Aluminum is present in bound form in many soils, and it can be dissolved and become available for accumulation by organisms to which it can be toxic. Dissolution of aluminum or other metals depends on the amount of water passing over a surface; solubility generally is enhanced in an acidic solution. Thus heavy rainfall exceeding surface evaporation--even with low acid content--can mobilize ions over time. This mobilization from the soil may be enhanced when acid-forming materials also are deposited from the atmosphere and washed away.

HAZE ON THE HORIZON

Blue Skies, Nothin' but Blue Skies might not be hummed by many Hoosiers this summer, as what some scientists term "acid haze" settles over our state.

BY KATHLYN GAY

"IT'S NOT THE HEAT, IT'S THE HUMIDITY." You hear that statement often during the hot summer days in Indianapolis and most of the Hoosier state. It's a common explanation for the sticky feeling and the haze that settles over the area. Yet, in Indianapolis and other parts of the Ohio River Basin, it's not humidity alone which casts the dark shroud in the midst of summer. An accumulation of pollutants in the lower atmosphere contributes to the problem.

The combination of sulfate particulates and absorbed moisture in the atmosphere causes a haziness and resultant lack of visibility in Indianapolis. The high frequency of morning ground fog over the five-state Ohio River Valley is a further result of the same combination. Such sulfate episodes, often lasting a week or more at a time, create serious visibility problems for many areas in the eastern United States, according to Orie L. Loucks, research scientist with the Holcomb Research Institute, Butler University. But the "acid haze," in combination with other pollutants in such urban areas as Indianapolis, also damages foliage and threatens plant life, particularly conifers.

How and where does "acid haze," or fog, originate? It's part of the pollution problem known popularly as "acid rain." The precursors of acid compounds are gaseous sulfur and nitrogen oxides which are released into the air from industrial and electric utility smokestacks and from vehicle exhausts — the result of fossil fuel combustion, much of it the burning of high-sulfur coal to generate electricity in upwind states such as Missouri, Illinois and Kentucky, as well as Indiana.

Some of the sulfur dioxide and nitrogen compounds released are transformed to sulfuric and nitric acids as well as sulfate and nitrate particulate compounds. Both the acids and particulate compounds can be removed from the air by moisture. The pollutants – whether in gaseous, particle or liquid forms – often fall back to the earth near their source, or they can be carried long distances through the atmosphere before being deposited hundreds or even perhaps thousands of miles downwind from their origin.

Acidic substances can be neutralized by alkaline materials such as calcium in soil blown into the air. But many aspects of the interactions of acidic and alkaline compounds — both in the atmosphere and in the soils — are not yet fully understood. The problem is further complicated by the presence of ozone. The protective layer of ozone surrounding the earth at 30,000-50,000 feet has received a great deal of public attention. Ozone in the lower atmosphere is a health hazard and regulated pollutant. Even though ozone is more damaging to plants than to humans, the standards are set for normal human tolerance.

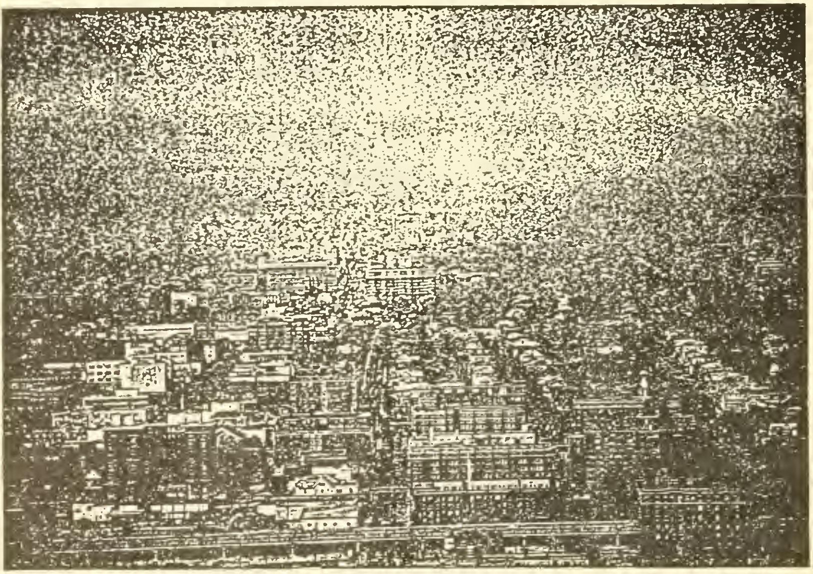
Ozone is hard to control because it is not emitted. The problems begin when it combines with hydrocarbons (such as auto emissions) or nitrogen oxide.

In a 1979-80 study, biologist Roland Usher of Greenfield, Indiana and plant pathologist Wayne Williams of California, examined stands of white pine trees in rural and urban Indiana, including a site south of Bloomington, several near power plants and others just south of Indianapolis and in Carmel. Their study found that "air pollution disease was widespread on eastern white pines in Indiana" and ozone and sulfur dioxide were "the primary causal agents" of the disease.

Under normal conditions many species of trees in the state should have a 200-300 year life span, but 30-40 years may be the limit for those stricken with air pollution disease. Loucks, who has been observing and documenting foliage damage in the area during the past five years, says, "I once thought I'd find much more evidence of diseased trees in New York, Boston, Minneapolis, and Chicago, but foliage damage in those cities is less than in Indianapolis. In fact, foliage conditions in this area and the rest of the Ohio River Valley are about the poorest in the nation."

Loucks is quick to point out that vegetation can be and often is damaged by other factors, such as salt used for deicing in the winter. Salt spray can kill plants, with effects usually showing up in the spring. However, when evergreen foliage yellows in late summer and fall and continues to deteriorate in spring, usually such conditions can be traced to the combination of ozone, sulfur oxide and acidic deposition, Loucks says.

If sickly trees and poor visibility cause no great outcry, possible hazards to human health may raise some voices in protest. Although medical



What some scientists call "acidic haze" is visible on the Indianapolis horizon.

practitioners insist they have never had any patients die directly from air pollution, studies show that the elderly and those with chronic heart and lung diseases are at risk from "acid fallout." A recent U.S. Office of Technology Assessment (OTA) report explains that the 30 million tons of sulfur dioxide emitted each year in the U.S. is not a health hazard "at normal environmental concentrations," but the transformation products — sulfate particles — are of "greater concern" since they "can readily be inhaled into the deep passages of the lung."

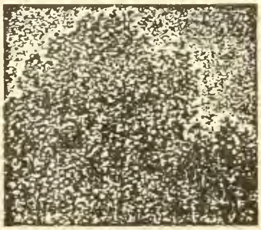
According to the OTA, "Acute exposures to sulfates . . . constrict lung passages and lengthen lung clearance times in humans and laboratory animals; chronic exposure of laboratory animals to sulfuric acid mist produced evidence of the onset of chronic lung disease. In addition, numerous epidemiological studies have found correlations between ambient sulfate concentrations and mortality rates."

The real and apparent hazards from acidic pollutants have created a great deal of controversy in Indiana and across the nation. In the first place, the acid rain/fog/haze problem is much more difficult to comprehend than the pollutant concerns of the 1960s. One could readily see (and smell) the foul waterways and choking air masses of two decades ago.

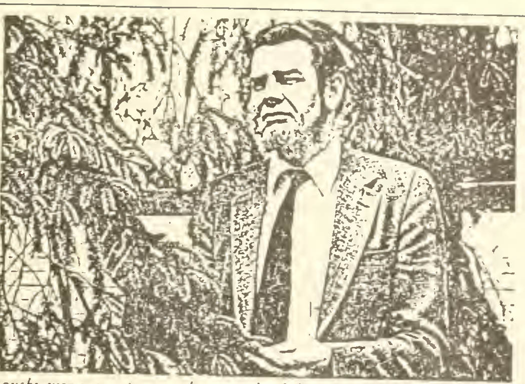
"During the 1960s, we could make a direct connection between toxic effects and certain chemicals — analysis and corrective steps were relatively easy to accomplish," Loucks explained, adding that "today's environmental questions deal with regional and long-term effects from low or chronic levels of pollutants which are often too subtle to rank high on the public agenda."

Loucks has headed several major studies on acid rain and related air pollution effects. His findings, and studies by a number of other scientists, show that acidic substances from the Ohio River Valley have been implicated as the direct or indirect agents in destroying aquatic life in hundreds of lakes and streams across the eastern United States and in Canada. The region is sensitive to acid fallout due to exposed bedrock and thin soils unable to buffer acidic substances.

In a seven-year study recently completed, Indiana University biologist Donald Whitehead also connects Midwest sulfur output with acidic deposition that damages aquatic systems in the Northeast. He contends sulfur emissions from electric utilities in Indiana and other states of the Ohio River Basin trigger acid deposition



Research scientist Dr. Orie Loucks claims foliage yellowing in summer results from pollution, and is the first sign of stress.



Loucks examines a tree on the grounds of the Indianapolis Museum of Art, where he has been making observations of foliage condition and other air pollution symptoms.

over the Adirondack lakes and watershed, altering or destroying life associated with the wilderness ecosystems.

To some observers, the long-distance transport and deposition of acidic substances is rather like allowing Ohio Valley residents to dump their garbage in their neighbors' backyards to the East, creating environmental and health hazards, without accepting responsibility for cleaning up the mess. Many political leaders in the Northeast and some researchers are urging more strict control of sulfur emissions, particularly from the Midwest, declaring enough evidence exists to conclude that Midwestern sources are the prime culprits.

Critics of this view admit there may be some long-distance connection, but say there is no positive proof that any specific sources are to blame for acid fallout hundreds of miles away. They believe more research is needed before any new legislation is passed to curb sulfur emissions beyond what is already required by federal and state regulations.

"Certainly we are not against clean air," explained James Evans, director of Corporate Communications, Indianapolis Power and Light Company (IPL), further pointing out that IPL complies with present standards for emissions, but the utility company "believes scientists should be in agreement regarding the effects of acid rain — determine what the problem is and how to solve it before added expensive controls for emissions are required."

The utility spokesman added that IPL "is very conscious of rates and the company's rates are in the bottom one-third compared to those across the nation. We would not want to raise rates to pay for controls that may not do the job," Evans said.

Most opponents of added emission controls say it would cost billions to reduce sulfur emissions by such measures as coal washing, retiring old power plants which create the most pollution, installing flue gas desulfurization systems (scrubbers) and bringing in low-sulfur coal to burn. Because of control costs, some Indiana utility representatives say consumers might have to pay 50 percent more for electricity. Others argue that abatement measures, such as using low-sulfur coal from regions outside the Ohio River Valley, could result in the loss of thousands of jobs.

Public Service Indiana, the state's largest electric utility, in a brochure titled, *Acid Rain Issues Important to Utilities and Consumers*, points to another factor, claiming that "drastic cuts in power plant emissions might have little noticeable effect on acid rain. Statistics gathered from six Midwestern states (including Indiana) show that although coal consumption increased an average of more than 12 percent from 1975 to 1980, sulfur dioxide emissions decreased almost 16 percent. Yet there has been no corresponding downward trend in rainfall acidity. A 'cause and effect' relationship between sulfur dioxide emissions and acidity does not appear to exist."

In one of the many Congressional hearings on acid rain, Loucks explained that "Despite the declining sulfur sources, acidity of rainfall has stayed about the same because of recent increases in nitric acid content." He also emphasized that "reduction in sulfate is being observed in the Northeast, a consequence of reduction in sulfur dioxide emissions."

As for reports that electric rates would double to pay for emission controls, several studies show consumer costs will go up only $25-$30 per customer over a 10-year period. A first-

WHAT IS ACID RAIN?

What are the effects of the chemical brew known by the catch-all label "acid rain?" Scientific and government reports indicate that acidic substances destroy aquatic life from the base of the food chain, including microscopic plants and animals, to fish at the top. According to scientists, hundreds of lakes and streams across the eastern U.S. and thousands in Canada have been affected by acidic deposition from such sources as Midwest power plants. Some species in eastern forests are threatened by acid fallout, since acidic substances deposited in soils can leach nutrients and mobilize toxic elements.

Damage to aquatic and forest life has been well documented, but other effects of acid rain may be more circumstantial. However, acid fallout has been implicated as a health hazard, especially for those with respiratory ailments, and acid deposition has also been blamed for corroding metal structures and eroding surface features of famous sculptures and monuments, particularly in eastern states and Washington, D.C. Acid deposition may also alter chemicals used outdoors, possibly affecting paint finishes on vehicles as well as buildings.

According to the National Academy of Sciences, there is sufficient evidence that acid rain/fog/haze/etc. is damaging parts of the environment. The primary debate, though, centers on the best way to reduce the forerunners of acid rain (sulfur dioxide and nitrogen oxides), and whether benefits of controls outweigh the costs.●

step 25 percent abatement (in emissions) "can be achieved over a five-year period with no major capital expenditures," Loucks believes, "with use of least emissions dispatch (continuous use of modern low emissions-generating facilities) and selective use of eastern low-sulfur coal. Depending on the results of further studies, a possible 75 percent decrease in pollutant emissions may be required over a 20-to-30-year period."

For some time, Loucks and a few other scientists have been calling attention to the public benefits from reducing acidic pollutants. Pointing to the Indianapolis area specifically, Loucks believes that improving amenities (such as visibility) will help attract high technology firms. "These companies hire employees who are concerned about the quality of life — clean air, an attractive, healthy environment, plenty of green space and so on. If we are going to convince high-tech firms that they should relocate in Indianapolis, and thus help change our industrial base for economic growth, we must be able to offer some of the amenities that the companies might otherwise seek in the South and West," Loucks says.

Amendments designed to strengthen the Clean Air Act are being re-introduced for consideration by this Congress. Last year, after many briefings by qualified scientists (Loucks among them), a 15-member U.S. Senate Environment Committee unanimously passed a proposed amendment to the Clean Air Act which would require reduction of the 20 million tons of sulfur dioxide emissions allowed per year since 1980. If the amendment is approved by Congress, electric utilities in the East and Midwest would be required to reduce sulfur dioxide emissions to 12 million tons per year by 1994. Indiana and Ohio emissions would be cut back 40-50 percent, greatly alleviating problems associated with air pollution in the area. In that case, blue skies could again be a common sight — as they once were during Hoosier summers.

Kathlyn Gay, a free-lance writer, has recently completed a book, Acid Rain, *published by Franklin Watts, New York, as part of an Environmental Impact Series. It is due to be released in fall 1983.*•

Abstract[1]

Effects of Current Indiana Air Pollutants on Crops, Forests and Horticultural Materials

Orie L. Loucks
Research Scientist, Holcomb Research Institute, Butler University

Numerous recent studies have shown that under present conditions, agricultural crops, trees, and horticultural and garden plants are being weakened or damaged by air pollutants at lower concentrations than previously recognized. The higher sensitivity appears to result from the simultaneous presence of multiple toxic pollutants in both urban and rural environments. Despite generally meeting federal standards, these pollutants exist in combination at substantially higher concentrations in Indiana and the Ohio Valley than in most other parts of the United States. The pollutants of concern include sulfur dioxide (SO_2), ozone (O_3) and nitrogen oxides (grouped as NO_x). Acidity in sulfate-induced ground fog, where pH has been measured at 2.8, also appears to be a problem for vegetation in Indiana during warm weather periods.

Studies of vegetation in Indiana show a loss of plant vigor, loss of foliage color, and increased mortality of trees and other horticultural materials, particularly in the urban areas. Effects on crops are primarily in the form of reduced yield. Significant pollutant concentrations, as a mixture of $O_3 + SO_2 + NO_x$ + acidity, probably have been present only about fifteen years, so recognition of the effects on plants has been recent. This corresponds with the period during which agricultural yields have failed to increase, despite continued improvements in technology. Since trees tolerate a long period of stress before they die, mortality in Indianapolis is now reaching epidemic levels. Comparisons with other large cities show pollutant-induced foliage disease and mortality in Indianapolis to be considerably worse than those cities. The extreme plant damage here appears to result from the high, sustained background levels of SO_2, O_3 and acid fog in the region in addition to the urban area pollutant load which characterizes all cities.

Five years of observations, data collection, and photographs in Indianapolis show:

- An air pollution disease index for white pine shows foliage to be 50% worse in the Indianapolis area than in rural Indiana, which is about 50% worse than rural areas northwest of Chicago;
- There is currently 5 to 10% mortality annually of all residential and park plantings of conifers in Indianapolis, an average cost per household of about $200/year;
- Numerous types of garden crops and flowers show reduced vigor and early senescence from air pollutants;
- Discoloration, early leaf-drop and mortality of foliage tips is being observed for most species of broadleaf trees and shrubs in residential and public park areas of Indianapolis;
- Unusually reduced growth rates, as shown by narrowed annual rings, are being observed on all but the most tolerant conifers in the urban area, and ring-widths fluctuate within the year-to-year variation in pollutant concentrations.

In addition, agricultural crop losses in rural Indiana are being estimated in recent congressional studies at 8 to 16% of total yields, depending on crop variety and weather.

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[1] Paper to be presented at a symposium, Jobs and a Clean Environment for Indiana, Indianapolis, March 5, 1983.

State Crops Hurt By Air Pollution

By DAVID McCARTY

The world's agriculture, already plagued by insects, drought, diseases and unstable prices, now also faces what the United Nations calls "a totally new threat" — air pollution.

And experts say Indiana, along with its neighboring states, is one of the world's worst areas for air pollution-caused crop damage.

"I think Indiana is potentially one of the worst, along with Ohio and Southern Illinois, because of the weather patterns. There's more stagnation there," explained Prof Allen Heagle, research plant pathologist at North Carolina State University.

Last month, ozone wiped out up to 75 percent of Southern Indiana's multimillion dollar melon crop. Some farmers spent as much as $100 an acre treating their fields in a futile effort to prevent further damage.

A recent report by the U.N, Environmental Program estimated annual air pollution damage to American crops at $3.1 billion. Other studies reported yield reductions in Midwestern fields of up to 26 percent for some crops.

According to Robert Friedman, project director of a national pollution damage study by the Office of Technology Assessment in Washington, D.C., nationwide soybean yields are down 10-15 percent, wheat is down five percent and corn harvests are down 2-3 percent because of air pollution.

"These are fairly high figures," said Friedman, adding that a deci-

Continued on Page 8

THE INDIANAPOLIS NEWS Wednesday, August 17, 1983

More About Pollution Hurts Crops

Continued from Page 1

sion is needed soon on whether it's less expensive to accept high crop losses or pay for the expensive air pollution control equipment needed to sufficiently reduce damaging air pollution in the field.

Others predict unacceptably high crop losses unless tighter air quality standards are imposed because air pollutants cause the most damage to plants already weakened by heat and drought.

Tony Endress, associate botanist with the Illinois Natural History Survey, has found yield reductions in corn and soybeans exposed to levels of ozone less than state standards.

He and other researchers fear ozone and sulphur dioxide — the Midwest's two most prominent air pollutants — combine to inflict greater damage than either pollutant causes alone.

Plants are much more susceptible to air pollution stress than animals, which have evolved efficient filters in the nasal and bronchial passages to filter most dust and pollutants, Friedman said. Plants accept unfiltered air directly into the cells responsible for growth and food production.

"As soon as the air enters their pores, the toxic gases come directly in contact with the cells containing the chlorophyll," explained Orie Loucks, a research scientist with the Holcomb Research Institute at Butler University.

Air pollution also makes plants less resistant to insects. Plants may close their pores to keep out ozone, cutting off the carbon dioxide needed for food production. Ozone may also cause biological damage to the cells.

Loucks said he is quite concerned over the future of many plants in Indiana because the state has "a combination of pollutants most regions don't have."

In addition to increased levels of ozone and sulphur dioxide, Indiana receives periodic acid fogs, he warns, which damage crops directly and reduce the amount of sunlight they receive, penalizing Indiana farmers.

Another problem is that the stress of summer heat and drought, which already has lowered yields in Indiana and throughout the nation, is accentuated by the additional stress of air pollution.

Loucks said the greatest damage may be to Indiana's forests, because trees suffer annual damage from.

THE INDIANAPOLIS STAR — FRIDAY, JULY 22, 1983

Polluted air ruins Indiana cantaloupes

Vincennes, Ind. (AP) — Southern Indiana melon growers have lost up to 75 percent of their cantaloupe crop because of air pollution, researchers say

The U S Department of Agriculture says it's the first time air pollution damage to horticulture crops has been recognized in the Midwest

"This is not a casual problem," said USDA entomologist Gary Reed of Vincennes, who added that leaf injury also has been found in watermelons and potatoes in the area.

"There's more to it than meets the eye," he said. "You can't spray this problem away, and it's not an infectious disease Something else must be involved"

WALTER HECK, a USDA researcher with the air quality laboratory in Raleigh, N C , said, "The something else may be ozone, a potentially toxic gas formed in sunlight from oxygen, nitrogen oxides and hydrocarbons. The type of symptoms we saw in the leaves are ozone symptoms."

Heck has been researching effects of air pollution on crops for 24 years and is associated with the federally funded National Crop Loss Assessment Network

Researchers said other pollutants, such as sulfur dioxide, also may be contributing to the problem

Growers had been unsuccessfully spraying for the problem, which was diagnosed several weeks ago as the fungus, downey mildew. However, Purdue University plant pathologist, Rick Latin, said he became suspicious when he couldn't find disease spores

INJURED LEAVES were then sent to USDA research centers in South Carolina and North Carolina, and disease and insects were eliminated as the cause.

Mike Hagemeir, a Knox County grower who has lost three fourths of his cantaloupes, said that in the past four weeks he has spent more than $100 an acre trying to control the damage with chemicals. Since the problem was attributed to air pollution, he said he's unable to do any more than just watch his plants shrivel and die.

Purdue proposes plan to study air pollution damage to melons

VINCENNES, Ind. (AP) — Purdue University scientists have proposed a seven-stage plan to study air pollution damage in southwestern Indiana melon crops.

At a meeting Monday with university and Department of Agriculture researchers, state health officials and power company representatives, area growers were told that more needs to be known about the effects of air pollution on Midwest crops.

In the midst of summer's heat and drought, area melon fields were hit hard by leaf injury that was diagnosed as ozone and sulfur dioxide damage. In many fields, the damage caused leaves to wither and die, exposing the melons to sunburn.

"I believe we have a problem in southwestern Indiana," said Dr. Bruno Moser, head of the Purdue University horticulture department. "We won't get a real handle on what's going on until we get some specific information.

"We don't think the problem of air pollution in the Midwest is going away," he said.

Southwestern Indiana melon fields were initially targeted for study in the proposal, Moser said, but effects of air pollution on crops in other parts of the state may be studied as funding allows.

Moser said the study would cost at least $400,000 the first year, and $150,000 each additional year. Money for the study is not now available, he said, and growers were asked to lobby state legislators for project funding.

Rep. Frank McCloskey, D-Ind., said Monday he will work to get federal money for the study. He plans to meet next month with growers to document their plight.

The proposed plan includes:

- Direct monitoring of ozone, sulfur dioxide, nitrogen oxide, particulates and acid rain at selected sites during the growing season.
- Three monitoring stations, at an initial cost of about $50,000 each, would be operated.
- A field scouting program for about 30 selected southwestern Indiana fields.
- Plants known to be sensitive to air pollution will be planted as biological monitors.
- Educating growers to recognize symptoms.
- A hotline to speed communication between growers and researchers when air pollution injury is suspected.
- Screening and breeding programs to select pollution-resistant plants through field trials and controlled fumigation chambers.
- A study of interactions of air pollutants, cultural practices and environmental factors.

Symptoms in fields in the six-county melon belt were initially diagnosed as downey mildew fungus. When fungus spores were not found this summer, researchers with extensive background in air pollution damage to crops were brought in from Illinois and North Carolina.

Rick Latin, a Purdue plant pathologist who was instrumental in recognizing the problem, told growers Monday the experts agreed on two major points. The leaf injury is similar to problems caused by ozone and damage was probably worsened by interaction of ozone with sulfur dioxide, he said.

Plants can be injured at levels of pollutants lower than those thought to be dangerous to human health.

The air pollution problems were compounded this summer by the unusual weather patterns, said Purdue agronomy-climatologist James Newman. He said high pressure systems which occurred 57 of 92 days this summer compared with a normal occurrance of 35 days — created air inversions that held pollutants close to the ground. This summer as the second hottest and the seventh driest of this century, he said. The odds are about one in 25 of such a high crop stress growing season repeating next year, he said.

The growers are concerned, though, that air pollution will continue to threaten their livelihood. Some of the growers lost most of their crop to the combination of air pollution and drought.

"We have a lot of problems but pollution is our biggest," said Robert Wonning, president of the newly incorporated Southwest Indiana Melon and Vegetable Growers. "The fruit is not harmful for a person to eat. But the pollution is affecting the vines and our ability to grow melons."

6 The Vidette-Messenger, Valparaiso, Ind., Tuesday, October 18, 1983

Thursday, November 10, 1983 — THE INDIANAPOLIS NEWS

Innocent Victims Of Air Pollution Problem

By **DAVID McCARTY**

The same air pollution that forced Grecian authorities to move the Acropolis indoors stone by stone to escape the ravages of acid rain and other pollutants is eating away some of Indianapolis' most historic landmarks, experts say.

"It becomes very expensive when you're talking about damage to historic buildings," explained Walter Kulakowski, administrator of the city's Air Pollution Control Division.

"A lot of big cities have these problems," he added.

Most of the research into air pollution problems has been directed, he explained, at its damaging impact on public health — not buildings and monuments.

But even if pollution was reduced to levels considered safe for human health, Kulakowski said that might not be enough to prevent its corrosive effect on decorative metals, mortar, building materials and textiles.

"That damage isn't caused by the same concentrations of air pollutants that cause health problems," he explained.

The National Park Service is currently conducting two pilot programs to determine how much air pollution adds to the nation's annual bill to repair and clean building exteriors.

Billions

Preliminary estimates have put the total damage in the billions of dollars.

The deterioration is primarily caused by two pollutants — sulphates and nitrates — which combine with elements in the atmosphere to form acids.

The acid returns to earth as acid rain, snow, fog and even acid dust, all of which begin deteriorating building materials.

In Indiana, the problem is exacerbated by the frequent use of a common Indiana building material which is most susceptible to acidic decomposition — limestone.

"Limestone is a very fragile stone. The sulphur contained in emissions and acid rain reacts with the calcium carbonate in limestone to form a gypsum crust," explained John Dugger, properties manager for the Historic Landmarks Foundation of Indiana.

"When the stone is washed by rainwater, the gypsum is washed away. This may result in a loss of detail over time, but may prevent the heavy gypsum crust.

"When the stone is 'protected' and not continually washed by rain, the gypsum crust develops, resulting in black streaks and, eventually, seriously deteriorated and crumbling stone."

Examples of this deterioration can be found throughout cemeteries and on intricately carved limestone fixtures on some of the city's most historic old structures.

Neglected

Kulakowski told The News this "absolutely" is a neglected air pollution issue that will have to be addressed sooner or later.

Aggravating the problem is the lack of any protective coating to prevent the damage. And in many cases, the stoneworkers and other craftsmen needed to restore damaged surfaces cannot be found.

The Historic Landmarks Foundation of Indiana, however, already has started to fight back against the ravages of air pollution.

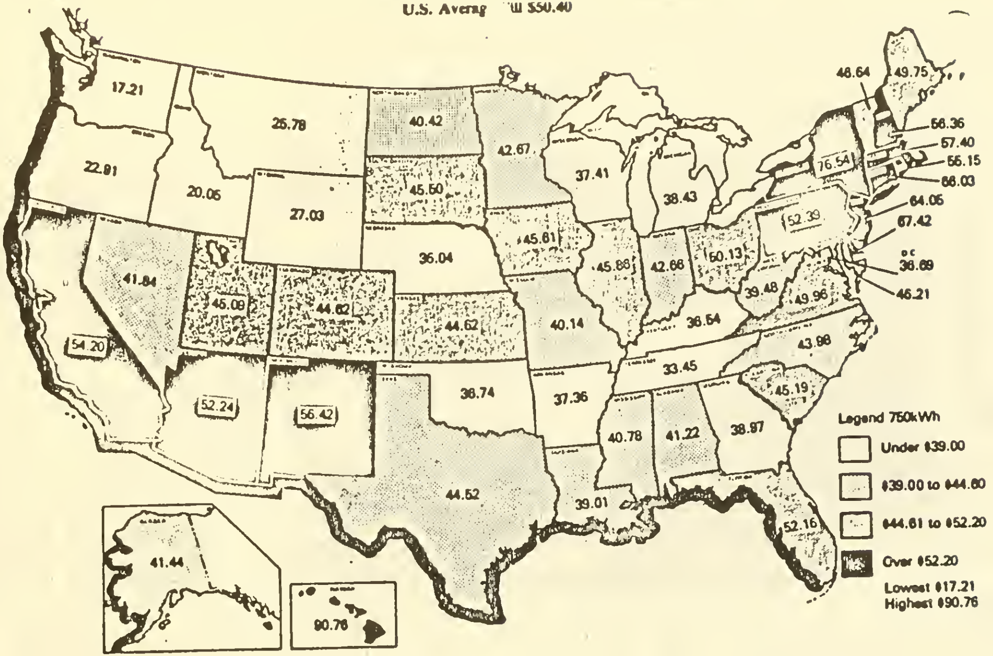
The group's recent restoration of the Benjamin Harrison statue in University Park earned it a special award from the Indianapolis Cleaner Air Committee.

Rather than use traditional sandblasting methods, which add to the city's already dust-laden air, HLFI removed the tarnish and corrosion from the statue with nonpolluting walnut shells.

"It looks very good now," Dugger said, proving that some progress can be made.

The NEWS Photo, Tim Halcomb

Tina Conner looks at cemetery marker.
Acid rain blamed for damage.



Note District of Columbia included

FIGURE 1 State Average Monthly Billls, 750 kWh Residential, January 1, 1982

Typical Electric Bills
Energy Information Administration

Natural Resources Defense Council, Inc.

1725 I STREET, N.W.
SUITE 600
WASHINGTON, D.C. 20006

202 223-8210

New York Office
122 EAST 42ND STREET
NEW YORK, N.Y. 10168
212 949-0049

Western Office
25 KEARNY STREET
SAN FRANCISCO, CALIF. 94108
415 421-6561

January 1984

For further information contact:
Liz Barratt-Brown
Bob Rose

State-by-State Acid Rain Control Costs

The charts, "State-by-State Acid Rain Control Costs on Residential Electric Bills" are attached. The chart provides information about cost breakdown in your state for the Stafford (S. 768), Mitchell (S. 145) and Waxman (H.R. 3400) bills. Information is not yet available for the New England Caucus bill.

To compute the costs, we added the projected increases to the 1982 average monthly household bill. Because residential use is typically 750 kwH/month, we selected the average bill at 750 kwH's in each state.

The sources are listed below:

1/ '82 750 Kwh Bill	DOE, Typical Electric Bills January 1, 1982, October, 1982. Figure 4.
2/ Stafford	ICF, Analysis of a Senate Emission Reduction Bill (S.3041), February, 1983. Table B-9.
3/ Mitchell	ICF, Analysis of a 10 Million Ton Reduction in Emissions from Existing Utility Power Plants, for EPA, June, 1982. Table 2-20.
4/ Waxman	OTA, Additional Analysis of H.R. 3400: "The National Acid Rain Depsoition Control Act of 1983", September 16, 1983. Table 2.

Phase 1 = 1 mill/kwh fee on 1 non-nuclear generated capacity (1 mill = $.001)

Phase 2 = fee and program costs (approximately 6 years)

Phase 3 = program costs

State	1982 Average 750 kwH Residential Bill[1]	$ Change with Controls[5] Stafford[2]	Mitchell[3]	Waxman[4]
INDIANA	$42.66	$3.11-3.07	$3.11-2.94	(a) $.75 (b) $3.53-4.42 (c) $2.78-3.67

IMPACT OF ACID RAIN CONTROLS ON INDIANA COAL PRODUCTION AND UTILITY RATES

SO_2 REDUCTION GOAL AND CONTROL PROPOSAL	1995 INDIANA COAL PRODUCTION FOR UTILITY MARKET (CHANGE FROM 1980 PRODUCTION LEVELS)	% INCREASE IN INDIANA UTILITY RATES	ESTIMATED TOTAL ANNUAL COST
10 million ton reduction via Mitchell Bill (S.1706)	10-20% decrease [a]	12-16% [b]	$3.3-4.1 billion [b]
10 million ton reduction via Waxman-Sikorski Bill (HR3400)	approx. 36% increase [c] (gain of roughly 3,000+ jobs)	phase 1 1.6% [d] phase 2 9.0% phase 3 7.4%	$ 2.0 billion [d] $4.9-5.5 billion $2.9-3.4 billion
8 million ton reduction achieved largely via coal-switching	approx. same as 1980 levels [e]	———	$3.7 billion [e]

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a. Congress' Office of Technology Assessment (hereafter OTA), The Effects of Acid Rain Control on the Coal Market, May 1982. Washington, D.C. Note: OTA's estimates are 57 to 90% lower than those of UMW/Peabody because OTA assumes a combination of fuel-switching and scrubber installation (EEI's survey of utilities supports this assumption). UMW/Peabody, on the other hand, assumes all reductions will be met by switching to low-sulphur coal. OTA used 27.3 million tons as Indiana's 1980 coal production level.

b. OTA, Staff Briefing Memo for the Senate Committee on Environment and Public Works, June 2, 1982, Washington, D.C.

c. ICF Incorporated, An Analysis of 12 Million Ton SO_2 Reduction Alternative with SO_2 Control Technology Subsidies, August 1983, Washington, D.C. Note: This analysis assumed an added 2 million ton reduction (as proposed in the Ottinger amendment to H.R.3400). 1980 Indiana coal production levels were 30.9 million tons according to this study.

d. OTA, An Analysis of the Sikorski/Waxman Acid Rain Control Proposal, June 21, 1983, Washington, D.C.

e. U.S. EPA, Office of Policy and Analysis, internal analyses November 1983, Washington, D.C.

Data table compiled from above sources by the Central Midwest Regional Office, National Audubon Society, 444 Barker Road, Michigan City, IN, 46360. For further clarification, call Karen Hollweg, Regional Representative, 219/879-3227.

12/83

Indiana Division

The Izaak Walton League of America
INCORPORATED
DEFENDERS OF SOIL, WOODS, WATERS AND WILDLIFE

OFFICERS SEPTEMBER 1983 – SEPTEMBER 1984

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1935 S BUCKEYE
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46901

February 3, 1984

PRINCIPAL FACTS GAINED DURING HOUR-LONG
CONVERSATION WITH MARTY IRWIN, OF THE INDIANA
DEPARTMENT OF COMMERCE THIS DATE, CONCERNING
INDIANA COAL MINING AND PRODUCTION

In 1983 there were approximately 5,000 persons employed in coal mining in Indiana. A peak of 7,000 were employed in 1981. Unemployment in the industry at present was put at 30%.

However, many of these persons are not actually direct mining personnel, also including the clerical and other support staffs. There was no immediately available breakdown by job classification.

The need for extensive support (or "paper-shuffling" staffs) was said due to safety and other mine laws and regulations enacted in about 1971.

Productivity in 1970 per person employed in the industry was 36 tons/day; in 1982, it was 21 tons/day. This is not an indication of lowered productivity per miner actually in the ground; that productivity is as high or higher than it was a decade ago. The decrease is because the production is calculated across many more employees, clerks, paper-pushers, etc.

The level of coal production in Indiana does not appear to vary substantially. It was 30.4 million tons in 1982, 30.9 million in 1980, and is expected to be about 29 million for 1983 (figures not yet available).

The cost of Indiana coal is about $36/ton delivered at the electric utility; and it costs $20/ton to get it out of the ground. Indiana coal presently brings in about $840-million annually.

However, Indiana industries and other state consumers spend about $1-billion a year buying outside coal, most of this from Illinois and Eastern Kentucky (metallurgical grade coal for the steel mills), and some from the plains states, although this is not presently a large requirement (low sulphur, that is). The big increment will come when I&M's Rockport plant goes on line, and that will consume 14-million tons a year, all of it from I&M's own mines in the West.

While Indiana produces 30+ million tons/year, it consumes some 45 million tons, exports 8 million tons, and imports 23.9 million. PSI's Gibson plant near the Wabash is presently the largest "importer." It gets its coal from the Illinois side of the river, but the coal is actually Indiana coal, since the Illinois mine is a deep shaft mine, angles under the river to the Indiana side. Legislation is now pending to establish that this is in fact Indiana coal. Gibson has scrubbers.

There are about 80 actual operating mines in the state, and this includes the small "Mom and Pop" ventures as well as the big mines. Most of the big mines are "captive", or supply just one or a couple of users.

Essentially all Indiana coal is used for steam generation, since it is not suitable at present for anything else.

Where United Mine Workers employment is most severely impacted is in the "old" mines which are beginning to deplete. Many of the smaller mines are non-union. Miners in the "old" mines are the workers most adversely affected and who are being laid off the fastest. Cost at these older mines is also the highest, because the workers have longer seniority, are most fully unionized, and have the largest fringe benefits (at least, so I am told).

But the mine regulations and laws of the 1971 period are said to be the largest influence in increased costs of coal, having something like doubled or tripled since that time. In answer to my direct question, it was not the 1977 U. S. Surface Mining Act which has been centrally responsible for coal cost increases, nor air laws.

It costs only about $8/ton to extract Montana coal (and presumably other high plains state coal); but the severance tax is 20% or more; and when transportation and other costs are included, delivery at the Indiana power plant is more or less comparable.

After Illinois and Eastern Kentucky, we get the next most imported coal from the region which includes Wyoming, Washington, Oregon and Montana (mostly Montana and Wyoming); and that amounts to some 2-million tons/year at present.

The foregoing was prepared from my notes of the phone discussion, and some of the figures may not wholly reconcile with each other; but in essence, these are the presently known data.

ES&T FEATURES

Selected strategies to reduce acidic deposition in the U.S.

Several SO_2 emission reduction strategies are examined and their attributes clarified. The effectiveness of each method is measured by the changes it produces in total sulfur deposition.

0013-936X/83/0916-0474A$01 50/0 © 1983 American Chemical Society

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Although the research needed to fully characterize acidic deposition and its range of effects is many years from completion, political initiatives are being taken today to formulate control programs aimed at reducing the emissions of atmospheric pollutants believed to be responsible for environmental damage. Information on what effects such emission reductions would have on acidic deposition is incomplete, and there is no certainty that decreases in emissions would significantly reduce the adverse effects of acidic deposition. Nevertheless, the political process is moving ahead rapidly at both national and international levels and may be outrunning the pace of scientific research.

This article is an attempt to shed light on this controversial policy issue by examining the attributes of several plausible acid deposition control strategies for the U.S. It discusses the costs of these strategies, the emission reductions that would be obtained, and certain secondary effects they would have on selected regions of the country. Rather than attempting to complete the cost-benefit equation—which is arguably impossible given the current state of knowledge—this study provides some measure of the potential effectiveness of these strategies by estimating consequent reductions in sulfur deposition. It describes a systematic approach to portions of an organized cost-benefit analysis of acid rain legislation, but it is not intended to provide the definitive answer to the problem. (Ecological benefits are not even addressed here.) Many of the components necessary for a complete assessment are being developed in various government and utility studies.

Despite the fact that acidic deposition and its effects are not fully understood, it is clear that certain types of strategies could be implemented to reduce precursor emissions or otherwise mitigate effects. This article emphasizes the approach that has the greatest chance of being implemented in the U.S.: continuous reduction in emissions of sulfur dioxide from electric utility power plants. While this is the most likely approach, other options are also discussed briefly: a decrease in nitrogen oxide emissions, a reduction in industrial or transportation emissions, intermittent fuel switching, and receptor mitigation (lake liming). The study examines several hypothetical sulfur dioxide control strategies, as well as other strategies that are currently being debated by congressional committees. Results are presented for the year 1995, based on the expected outcome of a 10-year program instituted in 1985. It is hoped that this analysis will contribute to the establishment of economically and environmentally sound policies for dealing with acidic deposition.

Analytical approach

To accomplish the objectives of this analysis, projections are made of the effects of various emission reduction strategies, each of which is implemented in the coal-fired electric utility power plant sector. The year 1980 is used as a base year; against this base are compared certain effects the following five alternative approaches would have in the year 1995:

- no specific acidic deposition control strategy (B95),
- a mandatory coal washing program (CWM),
- a ceiling on allowable SO_2 emissions of 2 lb $SO_2/10^6$ Btu (CP2),
- the Stafford bill, S. 3041 (STF), and
- the D'Amours bill, H.R. 4816 (DAM).

These approaches were chosen for close examination because they represent different conceptual approaches to a control program and because they cover a wide range of emission reductions. Other hypothetical approaches and congressional bills are discussed at appropriate points in the text.

The first three of these strategies—B95, CWM, and CP2—were analyzed in a joint study performed for the EPA, the Department of Energy (DOE), and Argonne National Laboratory by Teknekron Research, Inc. (*1*). In the Teknekron study, the Utility Simulation Model (USM) was used to project the effects of several control strategies for electric utilities (*2, 3*).

The USM consists of a number of interconnected computer modules and data sets that simulate decisions involved in utility system planning and operation and the impact of these decisions on utility finances and the environment. The model is driven by a set of exogenous parameters that include electricity demand, financial market conditions, fuel characteristics and availability, the use of advanced technologies, and environmental regulations. It simulates the joint operation of the various types of generating units and various capacity classes owned by all the utilities within a state. Output from the model includes fuel use, electricity generation, capital and equipment requirements, releases of environmental pollutants, financial statistics for utility firms, and average electricity prices.

The results of some of these control strategies were published earlier (*4*), and this article draws on these results for costs and secondary impacts (*1, 4*). State-level emission reductions for B95, CWM, and CP2 were calculated separately for use in long-range transport modeling (*5*). The USM results were obtained in 1980 and 1981 using the original version of the model employed by Teknekron Research, Inc., for EPA and DOE. The Universities Research Group on Energy (URGE), based at the University of Illinois at Urbana-Champaign, is currently designing an improved version of the USM called the Advanced Utility Simulation Model (AUSM). The values of the exogenous parameters reflect views of the future that were appropriate in 1980. Nevertheless, the results presented here are the best projections currently available, and improvements must await development of the AUSM.

The other two strategies—STF and DAM—are analyzed in a recent report, together with the other major acid rain control bills that were introduced into the 97th Congress: Mitchell (S. 1706), Moynihan (S. 1709), and Moffett (H.R. 4829) (*6*). It is difficult to project with any accuracy the costs of implementing each of these bills because of the many options they give the states for achieving the required emission reductions. In this study, therefore, only approximate cost estimates for the bills are provided, with no attempt to project secondary impacts. The Congressional Research Service has summarized analyses of the acid rain control bills that have been performed to date (*7*). The cost estimates in these analyses are in general agreement with those presented here.

The analysis in this article is restricted to the so-called acid rain mitigation study (ARMS) region, which covers the 31 states east of and bordering the Mississippi River and the District of Columbia (see, for example, Figure 1). This is the region addressed in the bills considered here and commonly used in technical analyses of the acid rain issue.

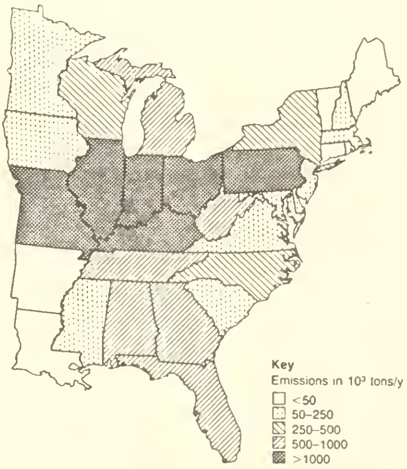
After discussing the regional costs

and emission reductions associated with each strategy, this article goes on to examine what effect each has on the following parameters:

- state-level emission reductions and costs,
- regional electricity prices,
- regional coal markets, and
- sulfur deposition.

The reductions in sulfur deposition resulting from emission changes are modeled using the advanced statistical trajectory regional air pollution (ASTRAP) model (*8*). Finally, the implications of the various strategies are discussed and compared with other approaches to reducing the potentially adverse effects of acidic deposition.

FIGURE 1
State-level distribution of 1980 utility emissions in the ARMS region



Specifications of each strategy

B95. The 1980 base case (B80) is compiled from a unit-level inventory created from DOE and EPA sources (*9*). Utility emissions are calculated from data on actual fuel use in the DOE/Federal Energy Regulatory Commission Form 67. The 1995 base case (B95) projects the emissions from utility sources in 1995 in the absence of any acid deposition control legislation. It includes new growth and retirement of older units and assumes that compliance with state implementation plans (SIPs) is achieved by 1985. Older units that were on-line prior to 1950 and smaller units with a generating capacity <100 MW are not required to meet the more stringent SIPs. In a sense, B95 represents a do-nothing strategy.

The emission reduction strategies are defined as follows:

CWM. This hypothetical approach consists of a mandatory requirement that all coal with sulfur content greater than 1.5% be cleaned by physical methods (*1*). The level of physical coal cleaning assumed in this analysis involves crushing the coal to a maximum diameter of 1.5 in. and flotation in a solution with a specific gravity of 1.6. The potential SO_2 emissions from the cleaned coal must be at least 10% lower than those from the raw coal.

CP2. This is the same as B95 except that a ceiling of 2 lb $SO_2/10^6$ Btu is placed on the allowable emissions from units meeting SIP limits. The advantage of such a ceiling is that emission reductions can generally be achieved by the use of low-sulfur or cleaned coal alone, without retrofitting the units with flue gas desulfurization systems.

STF. This strategy consists of implementing the Stafford bill, S. 3041 (a modified version of the Mitchell bill, S. 1706), approved by the Senate Committee on Environment and Public Works in July 1982 and introduced into the 97th Congress in November 1982. The Stafford bill sets a target SO_2 reduction of 8 million tons/y to be achieved in the ARMS region within 12 years of enactment. The decrease amounts to approximately 50% of the SO_2 emissions from the utilities in the 31-state region and 35% of the total SO_2 emissions in the region. State shares of the required reduction are to be determined in proportion to the ratio of the state's actual utility emissions in excess of 1.5 lb $SO_2/10^6$ Btu to the actual utility emissions in excess of 1.5 lb $SO_2/10^6$ Btu in the ARMS region. In addition, further reductions in SO_2 emissions from existing sources must be achieved to offset growth in SO_2 emissions from new sources. The growth offset has been analyzed elsewhere and is not addressed here (*6*).

The rationale behind the Stafford bill is to mandate a total level of reduction and then allow the states the flexibility of choosing their own methods of achieving it. Regional trading, energy conservation, early retirement, and least emissions dispatching are all permissible methods.

DAM. This approach entails implementation of the D'Amours bill, H R 4816, which was introduced into the 97th Congress in October 1981. The D'Amours bill is considered here because it attempts to focus the control strategy on the reductions that could be achieved by retrofitting flue gas desulfurization units on the power plants with the largest SO_2 emissions. The bill calls for a reduction equivalent to an 85% decrease in the SO_2 emissions from the 50 largest SO_2 emitters in the ARMS region. In addition, a ceiling of 1.2 lb $SO_2/10^6$ Btu is placed on the emissions from all other SIP units larger than 100 MW. Although the bill addresses the 50 largest power plant emitters in calculating the *magnitude* of the reduction, the *source* of the reduction can be any stationary source of SO_2 in the region. Alternative methods are allowed as under the Stafford bill.

It can be seen that these strategies

represent a range of possible approaches to the acid rain problem. The remainder of this article examines the relative merits of these strategies, assuming implementation by the year 1995. It is difficult to ascertain the uncertainties of the results presented here. To the best of our knowledge, no formal uncertainty analysis has yet been performed for the USM. Analysis of the two congressional bills is greatly hindered by the fact that it is impossible to predict which of several methods of reducing emissions or combinations thereof would be adopted by the states. The results should, therefore, be viewed as indicators of the relative effects of alternative strategies and not as accurate projections of the future. From our perspective in 1983, we believe that the growth in electricity demand used in the USM represents an unrealistically high forecast.

Since this analysis was performed, the acid rain issue has been taken up by the 98th Congress. In March 1983, Senator Stafford introduced S. 768, which is identical to S. 3041, the bill analyzed here. Simultaneously, he introduced a more restrictive bill, S. 769, mandating a 12 million tons/y reduction with offsets for new growth in SO_2 and NO_x emissions. Notable among other initiatives of the 98th Congress is the proposal by Representatives Sikorski, Waxman, and Gregg (H.R. 3400) to achieve a total reduction of about 14 million tons/y by retrofitting scrubbers on the 50 power plants with the highest SO_2 emissions and instituting other measures to decrease SO_2 and NO_x emissions from stationary and mobile sources. This bill is in many ways similar to the D'Amours bill. Work is under way to analyze these latest proposals in detail.

Regional impacts

In 1980, the actual SO_2 emissions from electric utility power plants in the ARMS region amounted to 15.9 million English short tons, most of which was from coal-fired units (*6*). This can be compared with an estimated 21.8 million tons/y from all sources in the ARMS region and 26.5 million tons/y from all sources of SO_2 nationwide (*10*). It is clear, based on economic, geographic, and feasibility criteria, that coal-fired power plants in the ARMS region represent the most likely target for major SO_2 emission reduction strategies. Figure 1 shows the state-level distribution of SO_2 emissions from utilities in the ARMS region in 1980. Table 1 summarizes the regional effects of the five control strategies.

Compared to the level of emissions in B80, the do-nothing strategy (B95) results in a modest decrease in annual emissions of approximately 0.3 million tons at no added cost. New growth in SO_2 emissions from stationary sources in the region is estimated to be about 1.9 million tons/y; a reduction of about 1.1 million tons/y would result from compliance with SIPs (*6*). The small decrease in emissions is a combination of these two factors, together with decreases resulting from the projected retirement of a number of older coal-fired units by 1995.

The coal-washing strategy (CWM) results in an overall annual reduction in emissions, relative to B80, of 1.7 million tons at a cost of approximately \$820 million/y by 1995. At \$470 per ton of SO_2 removed, this strategy is not very cost-effective. Also, it is unlikely that the limited SO_2 reductions obtained with this method would be large enough to substantially affect the amount of sulfur deposition.

The imposition of a 2 lb $SO_2/10^6$ Btu ceiling on allowable SO_2 emissions (CP2) yields an annual reduction of about 5.7 million tons at a cost of about \$1.7 billion/y. This strategy costs \$300/ton of SO_2 removed and is therefore more cost-effective than coal washing.

The two bills (STF and DAM) yield larger annual emission reductions of 8 and 9.9 million tons, respectively. Costs are difficult to determine for these two strategies because of the range of methods that can be used to implement them. The USM has not been used to project the effects of these bills. Cost estimates for STF performed by other groups are \$3.1 billion/y (*11*) and \$3.6 billion/y (*12*) in 1980 dollars. The D'Amours bill has not been analyzed elsewhere, but its cost is estimated at approximately \$4.0 billion/y (*6*), using a value of \$400/ton of SO_2 removed.

Under current regulations, the average price of electricity in the ARMS region is projected to rise from 5.1¢/kWh in 1985 (after SIP compliance has been achieved) to 5.37¢/kWh in 1995 (1980 dollars in both cases). The effect of both CWM and CP2 is to increase average prices by an additional 1% by 1995. The effects of STF and DAM would be more significant. ICF, Inc., estimates an increase by 1995 of 2.9% under STF (*11*).

The USM predicts that the generation capacity of power plants with scrubbers will increase from 70 GW (gigawatts) in 1985 to approximately 210 GW in 1995, with or without a coal-washing program (that is, with either B95 or CWM). Under CP2, about 65 GW of additional capacity would be scrubbed. Recent estimates of additional scrubbed capacity under STF vary widely from only 7 GW (*11*), to 22 GW (*12*), to a high of 89 GW (*13*).

Emission reductions and costs

Because sulfur dioxide emissions are currently greatest in the industrialized Midwest (Figure 1), the midwestern states would bear the brunt of the reduction requirement. Unfortunately, these same midwestern states are currently experiencing the worst of the economic recession and are consequently the least able to absorb any additional costs of pollution control. Table 2 lists the emission reductions

TABLE 1

Effects of the control strategies in the ARMS region

	Control strategy					
	B80	B95	CWM	CP2	STF	DAM
Regional SO_2 emissions (10^6 tons/y)	15.91	15.63	14.17	10.21	7.91	6.01
Reduction achieved[a] (10^6 tons/y)	—	0.28	1.74	5.70	8.00	9.90
Annual cost of control (10^9 1980 \$)	—	0	0.82	1.73	3.1–3.6	(3.97)[b]
Cost effectiveness of strategy (\$/ton reduced)	—	0	470	300	—	—
Average price of electricity (1980 ¢/kWh)	5.10[c]	5.37	5.41	5.44	—	—
Scrubbed capacity (GW)[d]	70.3[c]	212.1	211.2	276.0	—	—

[a] Relative to B80

[b] Value estimated at \$400/ton SO_2 removed.

[c] Values given are for 1985, after SIP compliance has been achieved

[d] Total capacity of units on which flue gas desulfurization systems are installed

required under each strategy in Pennsylvania, in the four midwestern states with the highest current emissions, and, for comparison, the state of Florida.

In the absence of acid rain control initiatives, emissions in 1995 are projected to be greater than 1980 emissions in three of these six states. The strategies discussed here require emission reductions ranging as high as 80% of the current utility emissions in Missouri. Clearly, under DAM the majority of larger power plants would be forced to retrofit a flue gas desulfurization system. In contrast, emission reductions required in Florida are no higher than 44%, due to the lower emission rates in that state.

Table 3 indicates that by 1995 control costs may increase by as much as $660 million/y for the state of Ohio. In contrast, a maximum increase of $130 million/y is projected for Florida. Cost-effectiveness is greater in the midwestern states, however, because a portion of the reduction in emissions can be obtained by switching fuels, cleaning coals, or blending coals. These options, however, entail disruption of traditional coal markets, which may have important social and political ramifications (discussed later in this article). Generally, the most cost-effective option is CP2, and the least cost-effective option is CWM. Figure 2 shows the pattern of state-level reductions in the ARMS region required by the most stringent control strategy: implementation of the D'Amours bill. It illustrates clearly that this stringent control program would have a potentially large impact on the industrialized midwestern states.

TABLE 2

Sulfur dioxide emissions under different strategies from utilities in selected industrialized states in the Midwest and Pennsylvania

State	Utility SO_2 emissions (10^3 tons/y)						Range of emission reductions [a] (%)
	B80	B95	CWM	CP2	STF	DAM	
Ohio	2240	1801	1465	890	819	583	20–74
Indiana	1522	1470	1315	807	527	589	3–65
Pennsylvania	1488	1243	1103	930	798	467	14–68
Missouri	1131	1158	1107	565	356	221	−2–80
Illinois	1115	1219	1136	637	464	363	−9–67
Florida[b]	705	779	739	634	459	393	−10–44

[a] Relative to B80. Negative values indicate B95 > B80.
[b] Southern state included for comparison purposes.

TABLE 3

Cost impacts of the four control strategies CWM, CP2, STF, and DAM on selected industrialized states of the Midwest and Pennsylvania[a]

State	Range of control cost increases ($10^6/y)[b]	Range of cost effectiveness ($/ton)[b]
Ohio	180–660	400–520
Indiana	80–400	260–500
Pennsylvania	100–390	330–940
Missouri	30–360	220–610
Illinois	30–300	210–510
Florida[c]	30–130	400–680

[a] All costs in 1980 dollars.
[b] Covering the four control strategies, relative to B80.
[c] Southern state included for comparison purposes

Regional electricity prices

The USM has a detailed financial module that simulates the costs and revenue requirements of 86 hypothetical utility firms, obtained by treating all investor-owned utilities within a given state as a single aggregate utility, and similarly treating all municipally owned utilities (*1*). It contains an accounting structure that provides an annual income statement, balance sheet, and sources and uses of funds for each of these "state" firms. The module also projects year-by-year utility expenses, including capital, operation and maintenance, and fuel. This structure enables the USM to project changes in electricity prices as a function of the implementation of a control strategy, where the price of electricity is defined as the total utility revenue requirements divided by the total sales to consumers. In this article, the effect of a single control strategy, CP2, on the price of electricity in the ARMS region is examined. The effects of STF and DAM are anticipated to be greater.

The regional average price of electricity in 1985 is projected to be 5.10¢/kWh. In the absence of any acid rain control program, this price would increase to 5.37¢/kWh by 1995—a 5.3% increase over the 1985 price. (All prices are in constant 1980 dollars.) Imposition of a 2 lb $SO_2/10^6$ Btu ceiling on allowable emissions would further increase this price to 5.44¢/kWh by 1995—a 1.3% increase over the 1995 price otherwise expected.

The effect on individual states in the region is variable, as Figure 3 shows. On the one hand, electricity prices in Ohio would increase by 16.8% between 1985 and 1995 under the current regulatory framework and by 21.4% with CP2. On the other hand, prices in Florida would increase by 4.1% under present regulations and by 4.7% with CP2.

Against this must be balanced the fact that electricity prices in the Midwest today are significantly lower than prices in the Atlantic Coast states. (The 1985 electricity price projection for Ohio is 4.1¢/kWh and for Florida is 6.4¢/kWh.) The proponents of strict control measures maintain that consumers in the East are currently paying higher prices for electricity partly because of a strong environmental stance taken in earlier years that included stringent SIPs and switching to clean fuels. Therefore, the increases in electricity prices in the Midwest must be accepted, they would argue, to bring midwestern states in line with the rest of the country. The Midwest would prefer an approach by which all states would contribute in appropriate, as yet undefined, amounts to the total costs of additional pollution control. The Sikorski-Waxman bill includes such an approach.

Regional coal markets

The effect of a particular control strategy on patterns of coal use can be important for determining the political viability of the strategy. The potential for major shifts in regional coal mar-

FIGURE 2
State-level distribution of emission reductions required by the DAM strategy

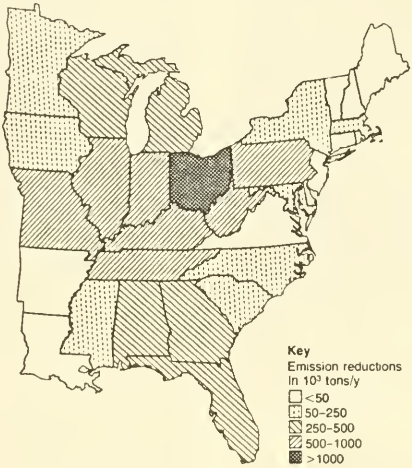
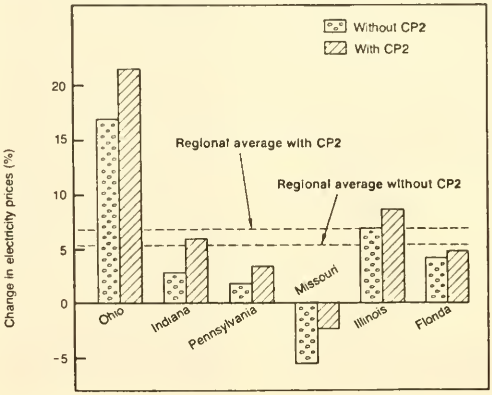


FIGURE 3
Changes in electricity prices in selected states in the ARMS region over the period 1985-95 under the CP2 strategy



kets can induce vigorous opposition to new initiatives in the states affected, which in turn can lead to powerful resistance in congressional committees and Congress itself. The protection of local coal industry production and jobs is a strong political force.

Implementation of emission reduction programs can force utility owners to switch fuels in order to comply with regulations at minimum cost. This may act to the detriment of traditional, local coal sources. Figure 4 shows projected patterns of utility coal consumption in the six states discussed previously, for the year 1995. For each state, the first bar represents the B95 strategy and the second bar represents the control strategy, CP2. B95 was chosen in preference to B80 in order to eliminate confounding factors arising from growth in coal use (that is, in Figure 4, the total coal consumption is approximately the same for the two strategies). CP2 was selected because it is the control scenario with the greatest potential for coal market disruption. This is because under a ceiling of 2 lb $SO_2/10^6$ Btu the optimum (least-cost) compliance strategy for the majority of plants would involve switching to a low-sulfur coal or blending an existing coal with lower-sulfur coals.

The more restrictive strategies, particularly DAM, are so stringent that flue gas desulfurization would probably be a requirement for many plants irrespective of coal sulfur content. Local midwestern coals, with high sulfur content, would therefore be preferred because of their lower cost.

Figure 4 reveals several interesting things. First, several states, exemplified by Pennsylvania and Florida, are relatively immune to coal market shifts, either because they have in-state low-sulfur coal supplies or because they are too far removed from alternative coal sources. It is interesting to find, however, that under CP2 in 1995, a certain amount of Powder River coal from Montana is projected to penetrate the Florida market, in spite of the large transportation costs involved. Second, several states in the center of the nation, typified by Missouri, currently use a number of different coal sources and are therefore quite flexible when control programs involving changes in emission limits are introduced.

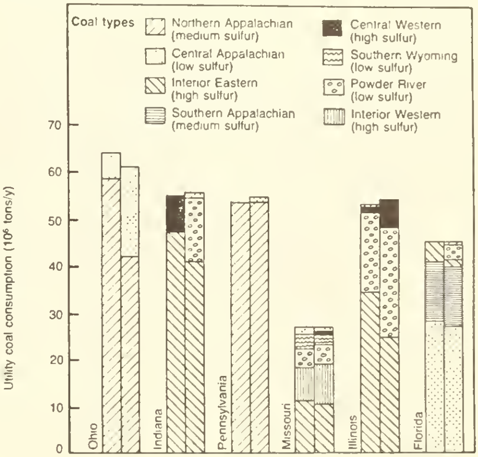
The states most vulnerable to coal market disruptions are those midwestern states such as Ohio, Indiana, and Illinois that currently rely heavily on relatively high-sulfur coals from in-state or from neighboring states. If a ceiling on emissions were imposed, low-sulfur coals from Central Appalachia (in the case of Ohio) and from the Powder River basin (in the cases of Indiana and Illinois) would penetrate the local markets in significant amounts to be used as compliance coals. The projected reductions in local coal use are 28% for Ohio, 28% for Illinois, and 13% for Indiana in 1995.

Therefore, control strategies such as the ones described here clearly present a conflict. The most cost-effective strategies cause the greatest disruption in coal markets, whereas the least cost-effective strategies tend to preserve local coal interests (see box).

To examine this phenomenon further, USM was used to project the effects of these same strategies with protection of local coal interests (*1*). A strategy was developed, CL2, which is identical to CP2 except that coal-switching options are limited to locally produced coals, for those states that are themselves major coal producers. Plants in the affected states were permitted only to switch to local, in-state coals or to install flue gas desulfurization systems. The effect of this constraint was to increase regional costs in 1995 by 6% ($1.84 billion/y as opposed to $1.73 billion/y) for the same reduction in emissions (5.7 million tons of SO_2/y). States potentially benefiting the most from local-coal protection provisions are Illinois, Indiana, and Ohio.

FIGURE 4

Patterns of utility coal consumption in selected states in the ARMS region in 1995, by supply region, for the strategies B95 (first bar) and CP2 (second bar)



Sulfur deposition

The ASTRAP model was used to convert the changes in SO_2 emissions that would be produced by these control strategies into projected changes in sulfur deposition patterns (*8*). ASTRAP and almost all other operational models of long-range transport and deposition assume a linear relationship between emissions and deposition for any single source and specified meteorological period; that is, if the emissions from source A are reduced by one-third, the deposition at receptor B associated with emissions from source A will be reduced by exactly one-third. This linearity assumption makes the deposition from different sources additive and allows the models to be used repeatedly in examining alternative strategies.

However, if source-receptor relationships are not linear, as some experts hold, the value of such simulations may be limited. Certainly, the relationship must be linear if integrated over sufficiently broad scales (e.g., globally and annually). The recent acid rain report prepared by the National Academy of Sciences concluded that there is no convincing evidence of significant nonlinearity in eastern North America if averaged on an annual basis over spatial scales of 1000 km or more (*14*).

It is quite likely that some transformation and removal processes are nonlinear, as they would be if NO_2 and SO_2 are in competition for available oxidants. The crux of the linearity-nonlinearity question is whether marked nonlinearities exist over scales commensurate with either emissions decisions (on a statewide annual basis) or ecological, material, or health effects. (These effects are not examined here, but the most widely accepted view at this time is that they are a function of long-term total sulfur and nitrogen deposition, perhaps independent of speciation [*15*].) The answer is not yet known.

In addition to questions about the linearity assumption, general uncertainties in modeling of transport and deposition are ill-defined. Model sensitivity is an inadequate substitute for model uncertainty. The horizontal net mass flux of pollutants is not monitored, and dry deposition cannot yet be successfully monitored on a routine basis (*16*). Thus, in any model two of the three sink terms for pollutants cannot be compared with observed data. In addition, wet deposition measurements integrate the contribution of all sources and do not directly measure the effect of a single source.

In preliminary comparisons with measurements of annual wet deposition of sulfur in four U.S. and Canadian networks, ASTRAP simulations explained 75% of the observed variance in 1980. This is not offered as proof that ASTRAP correctly simulates the sulfur deposition changes that would be associated with these proposed emission changes, but it is encouraging. These simulations do not consider changes in emissions from nonutility or Canadian sources, nor emissions of other acidifying pollutants, oxidizing agents, or neutralizing agents, because that is beyond the scope of the proposed legislation examined here, and in part beyond the capability of the model.

For this exercise, it was considered appropriate to examine the changes in deposition associated with changes in utility emissions resulting from all U.S and Canadian anthropogenic sulfur sources. All simulations are for one three-month summer season (June-August, 1980).

It is recognized that deposition

varies considerably from year to year. Indeed, wet deposition of pollutants is much reduced when precipitation itself is decreased, as in a drought, for example. To some extent, dry deposition then increases since more pollutant is available for this form of deposition. The meteorological data—primarily upper air winds and precipitation observations—necessary for many models exist. However, the time-consuming job of having a computer reformat the meteorological data into a usable synoptic form has not yet been undertaken. Therefore, to describe a systematic approach, a single season is examined here.

All simulations are for total (wet plus dry) deposition of anthropogenic sulfur. The 1980 base case in Figure 5 is calculated from an inventory of 27.9 million tons of SO_x emissions (expressed as SO_2) for the U.S. and 4.5 million tons for Canada. This inventory is a minor modification of the 1978 emissions inventory produced by the working groups established under the U.S.-Canadian Memorandum of Intent on Transboundary Air Pollution, and has seasonal and about 100-km resolution (*10*). The meteorological data—gridded 1000-mb and 850-mb wind fields and 24-h precipitation fields—were obtained from the Atmospheric Environment Service of Canada. The version of the model used here differs from that used in a recent report primarily because the wet removal parameters were adjusted according to a different resolution in the input precipitation data (*17*).

In the simulation using current total anthropogenic emissions, the maximum total sulfur seasonal deposition occurs in the upper Ohio River basin (Figure 5). It is in excess of 10 kg sulfur/ha. This simulation shows that almost all of the ARMS region and most of southeastern Canada have deposition rates greater than 2 kg sulfur/ha.

Table 4 shows how the sulfur deposition as calculated with the ASTRAP model (in kilotons of sulfur for the three-month period) varies with receptor region. The model predicts that approximately 60% of the total emissions are deposited on the North American continent. About 64% of that deposition occurs in the eastern U.S., and 17% occurs in eastern Canada.

The changes in deposition brought about by implementation of the five control strategies (B95, CWM, CP2, STF, and DAM) are simulated in the ASTRAP model by appropriate emission reductions at the state level applied to the utility sector component of the total inventory of SO_2 sources. The minimum resolution of the 1995 simulations is therefore statewide.

Figures 6–10 show the reductions in sulfur deposition achieved for each of the emission reduction strategies examined. Isopleths are of changes in deposition, measured in kg of sulfur/ha for the same three-month period. Note that Table 4 gives the same information according to region and control strategy. Changes in nonutility emissions and Canadian emissions are not considered.

It is interesting to observe that in the do-nothing strategy (B95), deposition is projected to increase slightly in two regions (eastern Canada and the western U.S.), and total deposition is reduced slightly. At the extreme opposite end of the range, implementation of the D'Amours bill (DAM) is estimated to reduce sulfur deposition in eastern North America by 41%—a reduction of 33% in total North American deposition.

The deposition simulations shown in Figures 6–10 can be examined with respect to the possible effects of the strategies on deposition in an ecologi-

FIGURE 5

Current patterns of sulfur deposition in kg/ha in the eastern U.S. and Canada from all anthropogenic sources

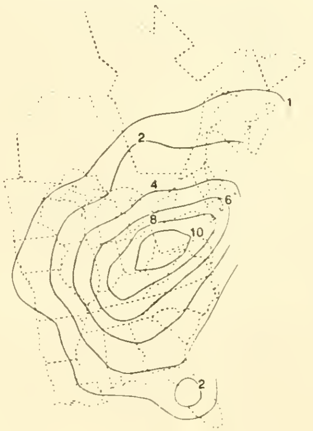


FIGURE 6

Sulfur deposition reduction in kg/ha in 1995 under the B95 strategy

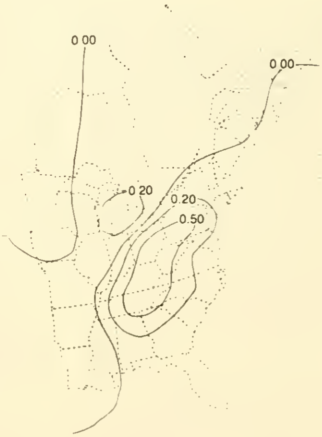


FIGURE 7
Sulfur deposition reduction in kg/ha in 1995 under the CWM strategy

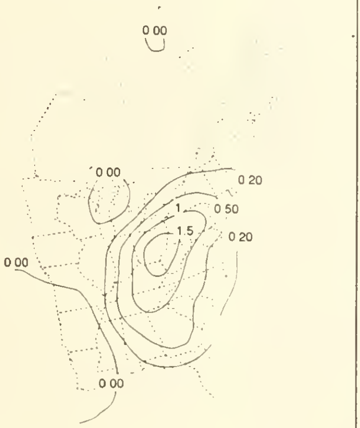


FIGURE 8
Sulfur deposition reduction in kg/ha in 1995 under the CP2 strategy

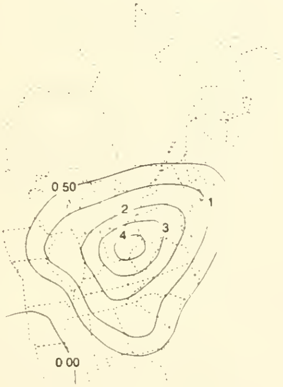


FIGURE 9
Sulfur deposition reduction in kg/ha in 1995 under the STF strategy

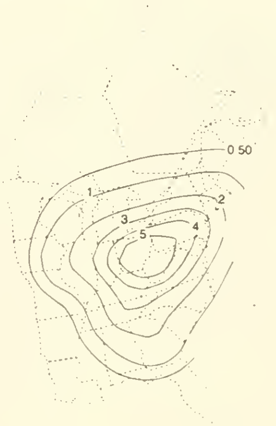
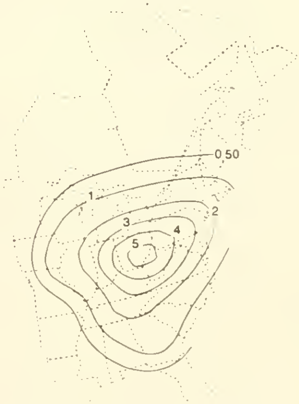


FIGURE 10
Sulfur deposition reduction in kg/ha in 1995 under the DAM strategy



cally sensitive region, the Adirondacks in New York State. According to the simulation of current conditions, the seasonal deposition of total sulfur here is about 3.8 kg sulfur ha^{-1}. Both B95 and CWM, which reduce emissions most in Tennessee, Kentucky, and Ohio, result in a deposition reduction pattern oriented southwest-northeast and reduce seasonal deposition in the Adirondacks by about 0.1 and 0.3 kg sulfur ha^{-1} $season^{-1}$, respectively. On the other hand, the emission reductions in CP2, STF, and DAM significantly affect many more states, and the resulting patterns of deposition change appear much like scaled versions of the current pattern (Figure 5), except in Canada and in parts of the Northeast where Canadian emissions contribute a significant share to the current pattern. The deposition reductions in the Adirondacks are about 0.8, 1.1, and 1.4 kg sulfur ha^{-1} $season^{-1}$, respectively, very nearly the same as the ratios of the overall emission reductions would indicate.

It is not surprising that in a linear model, broadly based emission reductions result in broad deposition reductions. At this time, proven methods are not available to translate these predicted changes in sulfur deposition to changes in measurable ecological response.

Discussion

The acidic deposition issue is fraught with major uncertainties. It is not known with certainty how much reduction in atmospheric emissions is necessary to mitigate the deleterious effects of acidic deposition, nor how that reduction should be assigned to achieve the greatest benefits for the least cost. And it is not known how quickly emissions must be lowered to protect sensitive receptors.

On the one hand, views have been expressed that the causal link between atmospheric emissions and adverse effects is tenuous, or, at best, unquantifiable. On the other, categorical assertions have been made that the link has been sufficiently demonstrated to support immediate action. Proponents of control have called for decreases in sulfur oxide emissions in excess of 10 million tons/y, while others recommend the treatment of selected lakes with lime and no reduction in emissions. It has been postulated that immediate action is necessary to prevent irreversible, long-term losses to sensitive ecosystems. The opposing viewpoint is that the time scale for damage is on the order of decades or longer and that the gradual replacement of old, uncontrolled plants by new, well-controlled plants is a sufficient strategy in itself.

This article has focused on a particular kind of strategy that would be favored if emission reductions are deemed necessary—a rollback in the emissions of SO_2 from coal-fired utility power plants in the eastern U.S. This kind of strategy has many advantages: The potential for the greatest absolute reduction exists in the utility sector in this region; it is almost certainly the most cost-effective strategy in terms of dollars per ton of pollutant removed; it is easy to implement; and it will have the minimum impact on the national economy per unit of pollution reduction. Arguably, it also addresses the actual cause of the problem, though the roles of local sources, oil-fired boilers, and non-SO_2 emissions are still being debated.

This article examines a range of SO_2 reduction strategies—a range both in terms of technical approach and in terms of the magnitude of SO_2 reduction (between 0 and 10 million tons/y). It does not advocate any particular approach because it is not known what magnitude and spatial configuration of reductions are necessary to alleviate adverse effects. Rather, an attempt is made to clarify the attributes of alternative types of strategies in order to facilitate the design of control programs that are efficient, equitable, and cause minimum disruption of other sectors of the economy. The "effectiveness" of a particular strategy is measured by the total amounts and regional patterns of changes in sulfur deposition as projected by the ASTRAP model.

Several conclusions regarding utility control programs can be made from this study. The do-nothing and mandatory coal washing strategies would in all likelihood be ineffective in reducing emissions and sulfur deposition by significant amounts by 1995. Coal washing is also less cost-effective than might have been anticipated. The effects of the Stafford and D'Amours bills would be very significant. Deposition would be reduced considerably, but costs would be high. Several midwestern states would receive economic shocks, with significant increases in electricity prices. An important observation on these strategies is that the deposition reductions are largest in the Ohio River basin and surrounding areas where present indications are that ecosystems are quite resilient to acidic deposition. The deposition reductions in areas with sensitive ecosystems such as the Adirondacks and Great Smoky Mountains are significantly less, drawing into question the effectiveness of such measures.

A 2 lb $SO_2/10^6$ Btu ceiling on SIP emissions would be cost-effective and produce reasonable reductions in deposition in comparison with the two bills. Its main drawback is that it causes disruption of existing coal supply patterns. One advantage of a simple ceiling on emissions allowed under SIPs is that regulatory enforcement and implementation of the program would be quite straightforward. The disadvantage of the flexible approaches such as STF and DAM is

TABLE 4

Changes in sulfur deposition as a result of implementing the control strategies

	Deposition (10^3 tons S/season)[a]					
Receptor region	Current[b]	ΔB95	ΔCWM	ΔCP2	ΔSTF	ΔDAM
Eastern U.S	1487	40	143	413	545	661
Eastern Canada	399	−6	10	57	85	100
Western U.S.	367	−1	−1	2	4	4
Western Canada	87	0	0	1	1	1
Total North America	2341	33	152	472	634	767
Percent of current eastern North American deposition	—	2	8	25	34	41
Percent of current total deposition	—	1	6	20	27	33
Emissions decrease[c]	3872[d]	35	219	717	1005	1243

[a] Deposition calculated by the ASTRAP model using meteorology for the three-month period June-August 1980. Units are English short tons of sulfur for the three-month period.

[b] Current deposition from all U.S.-Canadian man-made sources. Strategy Δ's are calculated relative to this base. A positive value indicates a reduction in deposition; a negative value indicates an increase.

[c] Decreases in emissions converted to tons of sulfur for the same three-month period.

[d] Current U.S.-Canadian anthropogenic emissions in the same units.

that a variety of technical solutions, including conservation programs and emissions trading, may be proposed that would frustrate implementation and enforcement activities.

The question of equity among the states applies to all the reduction strategies. Whether the costs of reducing emissions should be borne entirely by the states in which the largest emitters are located or whether all states in the ARMS region, or in the continental 48 states perhaps, should contribute in some way to the costs of control is debatable. One solution might be to impose a levy on all 48 continental states in proportion to, say, quantity of electricity produced (as in the Sikorski-Waxman bill) or quantity of SO_2 currently emitted. The fund generated could then pay for controls in the states where the most effective reduction could be achieved (see box).

Other approaches

How do these strategies to control SO_2 emissions from utilities compare with other possible approaches to the problem? Although the control of nitrogen oxide emissions from power plants would produce a reduction in acidic deposition, even less is known about the source-deposition relationship for nitrogen oxides than for sulfur oxides. Also, nitrogen oxides are generally believed to be less harmful to ecosystems than sulfur oxides. Several of the congressional bills (Mitchell, Moynihan, and Moffett) allow credits for reductions in NO_x emissions on the basis of two units of NO_x for each unit of SO_2 emissions, by weight. The potential for NO_x emission reductions in the utility sector is not high nor is it likely to be particularly effective. Utility NO_x emissions in the ARMS region are expected to rise from about five million tons/y in 1980 to six million tons/y in 1995 (*1*). However, the potential for reductions in NO_x emissions at existing boilers is limited. Improved combustion techniques such as low-NO_x burners, burners-out-of-service, and overfire air can reduce NO_x emission levels by only 30–50%, while the more efficient flue gas treatment processes are still under development and expected to be expensive.

ICF, Inc. has estimated that NO_x control strategies for utility boilers will be limited to about a 25% reduction in emissions, with cost effectiveness ranging from $50 per ton (for simple combustion modification of tangentially fired boilers) to $290 per ton (for wall-fired boilers) (*18*). The new limestone injection/multistage burner (LIMB) technology is promising, but not expected to be widely used before 1990.

Strategies that address sulfur oxide emissions from industrial fuel combustion or industrial processes, or nitrogen oxide emissions from transportation sources, will probably be ineffective in the absence of other measures. Industrial SO_2 emissions in 1995 are projected to be five million tons/y, and NO_x emissions from transportation are also projected to be about five million tons/y (*19*). In both cases, significant reductions in these levels would be cost-ineffective, difficult to implement and enforce, and potentially damaging to the economic well-being of specific industries. The utility sector is, in general, more robust in its ability to deal with price shocks than is the industrial sector, though it is certainly not as robust as it was in the past.

Update on pending acid rain legislation

Since this article was written, H.R. 4300 was introduced in the 98th Congress by Representatives Sikorski, Waxman, and Gregg. This bill requires a 10-million-ton reduction in SO_2 emissions and a 4-million-ton reduction in NO_x emissions. A large part of the SO_2 decrease is to be achieved by mandating that scrubbers be installed on the 50 power plants with the highest current SO_2 emissions. This requirement is included in the bill to minimize disruptions in the coal market (such as those discussed in this article). Because scrubbers are required on the 50 largest emitters, those plants would have no incentive to change to low-sulfur coal. Some smaller plants would probably switch fuels, causing certain changes in the coal markets but smaller disruptions than those projected under STF and DAM.

The Sikorski–Waxman bill establishes a 1 mill/kWh user fee on nonnuclear electricity generation throughout the 48 continental states. This money would be channeled into a trust fund to reimburse utilities for 90% of the capital cost of installing scrubbers. Thus, the cost of scrubbers, the major expense of acid rain control, would be spread throughout the nation. An analysis prepared by the Office of Technology Assessment projects that electricity rate increases under this bill would range from 1–10%, with an average of 3.2–3.7% during the most expensive years. The Sikorski–Waxman bill allows utilities less flexibility in choosing methods of SO_2 control than they would have under either STF or DAM, and the overall cost to the nation may be higher than that associated with either of the other two bills.

—Bette Hileman

If it is determined that regional emission reductions are necessary or desirable, then it would seem reasonable to specify utility sources as the vehicle for reduction, or at least to calculate the required decrease on this basis, but to permit trading with other categories of sources at prescribed "exchange rates." If it is ultimately determined, however, that the goal of reducing acidic deposition is to protect relatively small receptor areas, and that local sources are the primary contributors to deposition, then the need for regional emission reductions might be obviated and specific emitters or specific states would be targeted for control irrespective of source category.

The possibility of an intermittent fuel switching strategy has been proposed (*20*) and its feasibility analyzed to a limited extent (*21*). The rationale for this approach is that the conversion of sulfur oxides to sulfate tends to be episodic, corresponding to periods of stagnating high pressure systems in the eastern U.S. during spring and summer. If a significant fraction of the total acidic deposition occurred during these relatively few episodes during the year, then intermittent fuel switching from coal to natural gas or other clean fuel during these periods might be effective in reducing total deposition.

The feasibility study of intermittent fuel switching does not support the effectiveness of such a strategy. Sulfate deposition was found to be somewhat episodic in the northeastern U.S., with typically about 30% of the annual deposition being contributed in eight episodes totaling about 50 days annually. However, a simulated reduction in SO_2 emissions of 50% at all coal-fired power plants in the upper Ohio River basin during a stagnation episode produced only a minor reduction in sulfur deposition in downwind areas. The technical and implementation problems of extending the reduction either in space, time, or magnitude further inhibit the attractiveness of the strategy. The need for meteorological forecasting, alert mechanisms, and compliance verification would create additional problems.

Finally, the possibility of "receptor mitigation," as opposed to "source mitigation" should be considered. Liming of acidified lakes has been suggested as a solution to a problem that may be limited in geographical extent to a relatively few lakes in only a handful of areas. The obvious drawback to this approach is that it does nothing to ameliorate impacts on other ecosystems or materials, whether currently known, suspected, or unsuspected. There are several other disadvantages. Liming is not a permanent solution. Lime must be added to a lake periodically in an amount appropriate to the watershed and the current pH. Also, lime is a very impure substance that adds other pollutants such as heavy metals to the lakes.

Crocker et al. have attempted to evaluate the costs of a lake-liming strategy on the basis of several assumptions about the extent of liming necessary and the resultant lake pH levels that are desirable (*22*). The estimates range between about $400 million/y and $8 billion/y (in 1978 dollars). These costs are of the same order of magnitude as the costs of the SO_2 reduction strategies reported here. Fraser et al., in a study for the Electric Power Research Institute, estimate a cost of $100/acre for a lake-liming program, cautioning that the cost may vary significantly depending on the accessibility of the lake and its proximity to the limestone source (*23*). These investigators do not attempt to estimate the total costs of such a program. It is clear that further research is needed to fully identify the extent of liming that would be necessary and thereby to narrow the range of cost estimates.

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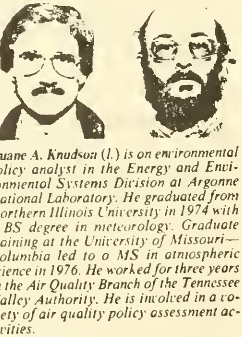

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Averting the Next War Between the States

The northeastern states want the midwestern states to reduce sulfur dioxide emissions because these emissions are damaging the northeast's environment. Midwestern states do not want to change the sulfur dioxide emission limits because they fear that lower limits would cause utilities to stop buying high sulfur midwestern coal. The solution lies in burning high sulfur coal cleanly.

by Kevin Greene

Coal mining is a major industry in Illinois, employing over 17,000 people. The closing of a single mine can cripple the economy of nearby communities. Seven hundred miles away, the Adirondack Park in New York is the source of local tourist and sport fishing businesses. Any deterioration of the region's natural resources could threaten the livelihood of this area.

Both regions are now linked by a complex problem: the long range transport of air pollutants. The high sulfur coal mined in Illinois is supplied to numerous power plants throughout the Midwest. When this high sulfur coal is burned, large quantities of the pollutant sulfur dioxide are emitted. In the atmosphere some of the sulfur dioxide is converted to sulfuric acid and acid-producing particles called sulfates. These substances are transported over long distances, and eventually the acids fall out of the atmosphere and are deposited in northeastern states such as New York.

Thus, both regions have a large stake in the development of regulations to control the long range transport problem. Illinois officials want to maintain the state's high sulfur coal industry. Increasing restrictions on sulfur dioxide emissions could upset their plans. New York officials are worried about the damage that acid deposition will cause to sensitive areas in their state. They want power plants in the Midwest to substantially cut back their sulfur dioxide emission levels.

This article will outline a long range transport control strategy that addresses the concerns of both regions. But first we must review the history of sulfur dioxide control to understand how we reached this point.

In recognition of the harm that air pollution causes, the US Congress adopted the Clean Air Act Amendments in 1970. This Act directed the US Environmental Protection Agency (US EPA) to set national ambient air quality standards for major air pollutants. Air quality standards were subsequently set for seven air pollutants, including sulfur dioxide.

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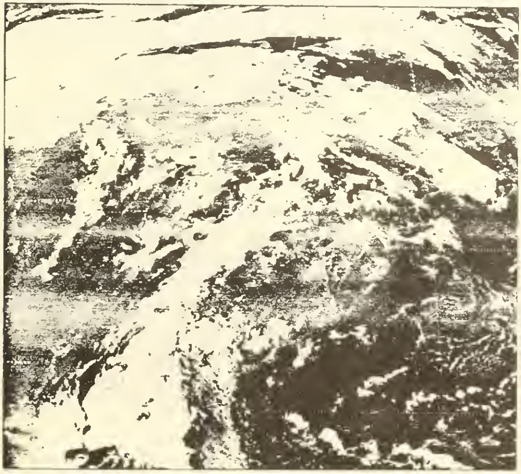


Photo courtesy of Mesomet Inc

Satellite photo shows a vast area of air pollution (hazy grey areas) from the Appalachians to the mid-Atlantic states and eastward to the ocean. The bright white areas are clouds, the dark areas are ground or ocean not obstructed by pollution. Among the pollutants are high levels of sulfates, sulfur dioxide, and ozone. This air mass circulated over the eastern half of the United States for 10 days.

Midwestern officials fear that switching to low sulfur western could threaten local mining jobs.

Each state was required to develop control strategies—state implementation plans (SIPs)—that would achieve the national standards. In the case of sulfur dioxide, state control efforts were directed toward fuel combustion sources, such as power plants. Emission limits were established for different areas based on the severity of local air pollution problems.

In Illinois, the emissions limits range from 1.8 pounds of sulfur dioxide per million British Thermal Units of heat input (lbs of SO_2/MMBTU) to 8.06 lbs of SO_2/MMBTU for existing plants. Existing plants are defined here as plants that were constructed before 1971. The 1.8 lb limit applies to existing plants in the major metropolitan areas of Illinois—Chicago, Peoria, and East St. Louis. This stringent limit was necessary because of the extremely poor air quality in these areas. Plants constructed after 1971 must comply with an even more stringent limit—1.2 lbs of SO_2/MMBTU (the new source performance standard).

In the early 1970s the most practical way to reduce emissions in the metropolitan areas was to burn low sulfur coal (less than 1% sulfur) instead of high sulfur coal (1% to 6% sulfur). Low sulfur coal could be found in the western states and certain parts of Appalachia. Although transporting low sulfur coal long distances increases the cost of the fuel, utilities can easily pass this cost to the ratepayer through the fuel adjustment clause. This clause enables utilities to charge the ratepayer for increases in fuel costs without undergoing a hearing before the public utilities commission.

Statistics from Commonwealth Edison, the largest consumer of coal in Illinois, illustrates the magnitude of the shift from high sulfur coal to low sulfur coal. Edison operates six power plants in the major metropolitan areas that had to comply with the 1.8 lb limit. In 1969, Edison burned 18.8 million tons of Illinois coal. Today Edison burns about 2.7 million tons of Illinois coal per year; the rest is imported from Montana and Wyoming. In the face of this large loss of business, several Illinois coal companies had to find markets in areas where the emission limits were higher.

Many lakes in New York are devoid of fish because of sulfur compounds that originate in the Midwest.

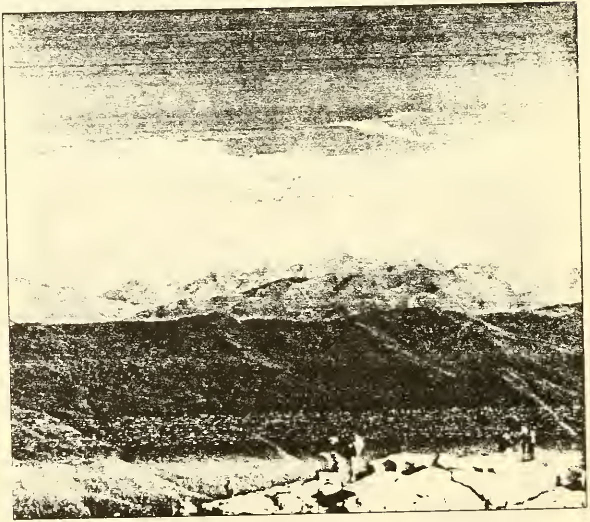
In the rural areas of Illinois, control strategies were designed to prevent the build-up of high sulfur dioxide concentrations near isolated sources of pollution. Emission limits were based on computer model projections of the effect of a single plant's emissions on air quality, taking into account plant operating characteristics (eg, stack height, exit gas velocity), local air quality, meteorology, and terrain. This approach fostered the use of tall stacks at power plants in rural areas because tall stacks disperse air pollutants high into the atmosphere and reduce ground-level concentrations.

Pollutant concentrations from a smokestack decrease when the plume mixes with large volumes of air. Wind and atmospheric turbulence then disperse pollutants. This process is enhanced by tall smokestacks. However, tall smokestacks cause a new problem: the long range transport of air pollutants.

When sulfur dioxide is released high into the atmosphere, it can be transported far from the source and along the way can be converted to sulfuric acid and sulfates. This phenomenon occurs especially in the summer when a slow moving air mass with high moisture content is quite common. For a few days, the air mass circulates over several areas of high sulfur dioxide emissions in the eastern half of the country. The air mass accumulates sulfur dioxide. The dispersion and dilution of pollutants is usually poor during this period because of the stagnation and inversion of air. (Dr. Lyons of Mesomet, Inc. compares the circulating air mass to the air around a fan in a closed room full of smokers. The air moves around, but it gets smokier and smokier as time passes. See satellite photo.) By the time the polluted air mass reaches the northeast, a significant fraction of the sulfur dioxide has been changed to sulfuric acid and sulfate.[1]

In New York, scientists analyzed the path (trajectory) of air masses to document the long range transport of air pollutants from the Midwest to their state. The studies revealed that high concentrations of sulfates were found when the air mass had passed over areas of high sulfur dioxide emissions. The highest concentrations of sulfates were recorded on the southwesterly winds that had stagnated over the Midwest twelve to thirty-six hours earlier.[2]

This is where the conflict between regions begins. New York officials are worried because several midwestern states are requesting that sulfur dioxide emission limits be raised at their power plants so that high sulfur coal can be burned. New York has petitioned the US EPA to disapprove any plans by the states of Illinois, Indiana, Michigan, Ohio, Tennessee,



These two photographs were taken from the same
left, visibility is over 50 miles, and the winds are
photo taken just two days later, the visibility has
now

and West Virginia to raise emission limits Seventeen plants in these states have requests for increases pending before the US EPA If these requests are approved, sulfur dioxide emissions will increase by about a million and a half tons per year.[3]

Usually the US EPA evaluates emission increase requests on an individual basis, considering only the local impacts of the emissions New York wants US EPA to study the cumulative and regional impact of increasing the sulfur dioxide emissions at all these plants

The New York attorney general is concerned about two power plants in Illinois—Commonwealth Edison's Kincaid Station and Illinois Power's Baldwin Station. Together these plants burned about 10% of the coal produced in Illinois and emitted approximately 445,000 tons of sulfur dioxide in 1980.

At the Kincaid station, located south of Springfield, Commonwealth Edison replaced two smokestacks with one stack (over 600 feet) that ejects the sulfur dioxide emissions higher into the atmosphere Because ground level concentrations have been reduced, the state has permitted Edison to emit up to 8 06 lbs of SO_2/MMBTU

The Baldwin Station, located in Randolph County southeast of St Louis, is the largest coal-fired plant in the state. The plant has three smokestacks over 600 feet tall. Illinois Power has requested that the sulfur dioxide emission limits for this plant be increased to 5 8 lbs of SO_2/MMBTU. The request is currently being evaluated.

New York officials do not want emissions limits at these plants to be changed. Moreover, they want these plants to substantially reduce their emissions Illinois officials fear that utilities would respond to stricter emission limits at these plants by switching to low sulfur coal Because these plants are supplied with coal from six Illinois mines, fuel switching could threaten the local mining jobs

Can substantial reductions in sulfur dioxide emissions be achieved in the Midwest without severe damage to the high sulfur coal industry? It may be possible by (1) focusing on the largest sulfur dioxide emitters, (2) installing pollution control equipment on these plants, (3) easing the financial burden of installing control equipment, and (4) raquiring that plants with pollution control equipment be used before plants without control equipment are used. Attention should paid particularly to those plants built just before the strict new source performance standards went into effect. These plants emit relatively large amounts of sulfur dioxide, have no pollution control equipment, and will be in service for 20 to 30 more years.

New York has petitioned US EPA to disapprove any requests to allow more sulfur dioxide to be emitted from midwestern plants.

In Illinois three plants would be strong candidates for further emission reductions under such a control strategy The plants are the Kincaid Station, the Baldwin Station, and Central Illinois Public Service Company's Coffeen Station. Together these three plants emitted 42% of all the sulfur dioxide emitted from power plants in Illinois in 1978 Kincaid emits about 7.0 lbs of SO_2/MMBTU, Baldwin emits about 5.8 lbs of SO_2/MMBTU, and Coffeen emits about 7 9 lbs of SO_2/MMBTU. These emissions are around six times the amount allowed for plants subject to the new source performance standards.

Sulfur dioxide emissions from these plants can be significantly reduced by two control methods The first method involves coal washing, which removes sulfur from the coal before combustion (See following article for description of coal washing) It is already being used at the Kincaid and Baldwin stations. A coal washing plant at the suppliar's mine has reduced the raw sulfur content of coal burned at Kincaid from an average of 4 4% to 3 7%. The Baldwin station uses coal that is sent to a central coal washing plant in Randolph county. The average sulfur content of this coal is reduced from 4 1% to 3 1% Coal used by the Coffeen station is unwashed The sulfur content of tha coal, which averages 3 7%, could be reduced by as much as 25% by coal washing

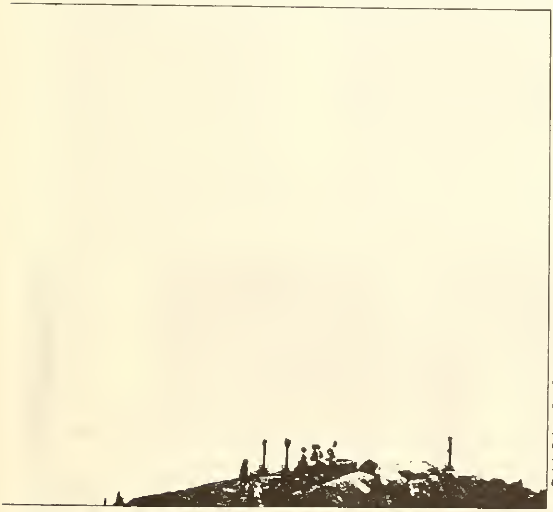


Photo by Professor Perry Samson, University of Michigan, courtesy of Mesomet Inc

ce atop Whiteface Mountain, New York On the
the northwest (from Canada) On the right, e
ped to 3 miles, the winds had shifted and were
m the southwest (from the Ohio River Valley).

Coal washing should be required for all midwestern power plants, especially in states where it is not extensively used. For example in Ohio, sulfur dioxide emissions can be reduced by more than 500,000 tons per year by coal washing.[4] Unfortunately, Internal Revenue Service rulings prohibit washing facilities from qualifying for investment tax credits and pollution control investments. These rulings discourage coal companies from building new coal washing facilities. This prohibition would have to be dropped to provide the proper financial incentive for these facilities.

The other major sulfur dioxide control method is flue gas desulfurization (scrubbing), which removes sulfur dioxide from the flue gas after combustion (see following article for description of scrubbers). Scrubbers can remove over 90% of the sulfur dioxide from the flue gas. However, most existing plants were not designed to accommodate scrubbers, and therefore may not achieve the same efficiency. Plants retrofitted with scrubbers should be required to remove 75% to 80% of the sulfur dioxide from the flue gas.

A scrubber system is expensive to build. Estimates of the cost of retrofitting a scrubber on an existing high sulfur coal burning plant range from $174 to $191 per kilowatt.[5] Some utilities may have difficulty raising capital for scrubber construction because of their poor financial condition.

This constraint could be reduced by programs that ease the burden of raising large sums of capital. For example, federal loan guarantees or low-interest loans could be made available to utilities for scrubber construction. Because long range transport is an interstate and international problem, federal support would be appropriate.[6] At the state level, utilities could be allowed to include, the cost of scrubber construction in the rate base prior to operation of the system. Because the public is currently using the polluting facilities, it would be equitable for the present ratepayer to provide funds for scrubber construction.

The solution:
1. **Focus on largest emitters.**
2. **Install pollution control equipment.**
3. **Ease financial burden.**
4. **Use uncontrolled plants last.**

The last step in a long range transport control strategy would be a requirement that utilities use facilities that are equipped with pollution control equipment first. Older, uncontrolled plants should be used only as back-up when electric demands are at their highest (peak load times). This concept is known as Least Emission Dispatching (LED). It may not be feasible to make LED a uniform requirement. Instead, LED should be applied on a case-by-case basis depending on the mix of power plants within an electric generating system.[6]

The control strategy outlined here attempts to minimize the economic impact of further sulfur dioxide emission reductions on the midwestern high sulfur coal industry. While some utilities may still choose to use low sulfur coal, sulfur dioxide emission reduction should be achieved by control technology whenever possible.

This goal may reduce public opposition to more stringent regulations in midwestern states where political leaders are more concerned about mining jobs than acidified lakes. It will also satisfy the northeastern states who are more concerned about their lakes than jobs in the Midwest.

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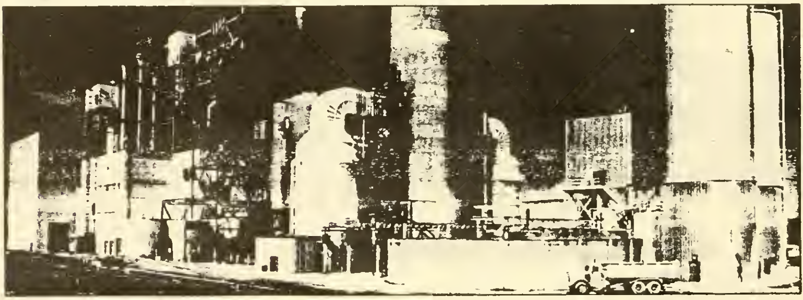


Photo courtesy of FMC Corporation

FMC Dual Alkali Flue Gas Desulfurization System at the A B Brown Electric Generating Station in Indiana. The scrubbers are the large, white vessels on either side of the smokestack, which is in the center of the photo.

The Laundering of Power Plant Emissions

by Kevin Greene

Three methods are available to utilities for reducing sulfur dioxide emissions

- Coal washing—removal of sulfur before combustion.
- Flue Gas Desulfurization (scrubbing)—removal of sulfur dioxide from the flue gas after combustion.
- Use of low sulfur coal.

The first two control methods will be the subject of this article. These methods are important because they provide a means of burning the high sulfur coal mined in Illinois and other midwestern states in an environmentally sound manner.

Coal Washing

Coal contains sulfur in two major forms: organic sulfur, which is chemically bonded to the coal, and pyritic sulfur, which occurs in coal as discrete particles. The organic sulfur cannot be removed unless the bonds are broken by chemical processes. Pyritic sulfur, however, can be physically removed.

The amount of sulfur that can be removed depends on the initial sulfur content of the raw coal, the ratio of pyritic sulfur to total sulfur, the size distribution of the pyritic sulfur, and the washing processes used.[1] The Illinois State Geological Survey reports that total sulfur in Illinois coal varies between 0.5% and 6.0% with an average of 3.57%.[2] About half the sulfur in the average Illinois coal is in the pyritic form.[3]

Coal washing processes depend on the physical differences between coal and pyritic sulfur. The most important is density in a liquid, pyrites sink while coal floats.

The Process

First the coal is crushed into small particles. The ground coal and pyrite is then conveyed to a tank or drum-shaped vessel, where the mixture is suspended in a liquid. The pyrites sink while the coal particles float to the top of the vessel for removal. Another process whirls coal and pyrite particles along with a liquid into a cone-shaped vessel, where the heavier pyrites migrate to the sides and fall to the bottom. The coal spins up and out through the top of the vessal.[4]

The extent to which pyritic sulfur can be removed economically varies among coal regions and among coal deposits within a region. The potential for sulfur reduction is determined by washability (float-and-sink) tests performed in a laboratory on the mine samples. The Illinois State Geological Survey has found that the sulfur content of Illinois coal can be reduced by 10% to 50%, with an average of 25%.[3]

The capital costs of coal washing range from $12 to $20 per ton of coal produced. Annual operating costs run from $3 to $8 per ton.[1]

Benefits

These costs can be offset by several benefits associated with coal washing. Besides pyritic sulfur, coal washing removes rock and ash-producing minerals. Roughly one carload of impurities—rocks, pyrites, and ash—can be removed from four carloads of raw coal.[4] Thus coal washing reduces transportation costs. Not only does the cleaned coal take up less space, but its heating value and combustion characteristics are improved. Because there is less ash, boilers are less likely to be shut down because of ash-caused fouling, slagging, and corrosion. Thus boiler maintenance costs will be reduced.

The cost savings from coal cleaning can range from $0.50 to $30.00 per ton of cleaned coal. Thus, coal washing may pay for itself in some cases.[1]

Finally, coal washing provides two additional benefits when used in conjunction with flue gas desulfurization. (1) There is less sulfur dioxide to be removed *after* combustion. (2) Variability in sulfur content is reduced, which makes it easier to design flue gas desulfurization systems that will meet the emissions limits.

Flue Gas Desulfurization

The Process

Flue gas desulfurization is a chemical process that removes sulfur dioxide from the flue gas after combustion. The process consists of three major steps. First, the sulfur dioxide-laden flue gas from the boiler enters a long vertical or horizontal chamber called a scrubber. There, it is mixed with a slurry of alkali—usually lime or limestone—and water. Sulfur dioxide is absorbed into the liquid, where it reacts with the dissolved alkali to form solid waste products. The cleaned gas goes through a demister, which removes water picked up from the slurry. The gas is then reheated and exhausted to the atmosphere through the stack.

The reacted waste products are drained from the scrubber with the slurry to holding tanks where the chemical reactions

CLEAN COAL COMICS
N°1
25¢
IT WAS THE MOST EXCITING THING TO HAPPEN IN THE OLD DIRTY COAL SEAM IN 250 MILLION YEARS...
YAY!
KABOOM!
THEY'D AT LAST BEEN BLASTED FREE! ON TO THE GLORIES OF THE POWER PLANT!
BUT THEN WORD CAME DOWN FROM ON HIGH ..
NOT GOOD ENOUGH FOR UNIT #3!
KCHUNG! KCHUNK
AND IT WAS TRUE THE COAL FROM THE OLD DIRTY MINE WAS DIRTY, WITH GUNK, SUCH AS ASH-PRODUCING MINERALS TO WRECK #3'S BOILER, AND SULFUR TO CONTRIBUTE TO SO2 EMISSIONS. THE WEIGHT OF THE GUNK ALONE WOULD DRIVE UP SHIPPING COSTS!
SNIFF!

Source *Electric Power Research Institute Journal* 4(5) June 1979 are completed. In a lime or limestone scrubber, the waste products consist primarily of calcium sulfite and calcium sulfate.

To remove these waste products, a portion of the liquid is pumped from the holding tank to equipment that separates the waste products from the liquid. The liquid is returned to the scrubber for reuse while the waste products are concentrated as sludge and discharged to a disposal area.

Early Scrubbers

Utilities have generally taken a dim view of scrubbers. Early systems were plagued by problems that decreased their efficiency and reliability. These included the build-up of mud-like deposits (scale) inside the scrubber, particularly on the demister; the corrosion of scrubber equipment, such as pipes and pumps, and the difficulty with disposal of a waste product that retains water. These problems were complicated by the fact that some utilities did not realize that a scrubber system is a complex chemical process that requires properly trained supervisory and operating personnel. Utilities would normally staff the scrubber with personnel from other power plant operations, rather than train personnel specifically for the scrubber operation. As a result, poor operation and maintenance practices would undermine scrubber performance.

Improvements

In recent years, scrubber technology has significantly improved. Better designs, greater understanding of process chemistry, careful selection of construction materials, and the training of personnel have eliminated or reduced many of the problems associated with early scrubber systems.

For example, the formation of scale can be prevented by closely monitoring process conditions in the scrubber. The plugging of demisters can be alleviated by washing the demisters periodically and utilizing more of the alkali in the process. The latter operation can be achieved by grinding limestone to a fine powder and using more than one holding tank to complete the chemical reactions.

To combat corrosion, manufacturers now specify the use of stainless steels in certain areas of the scrubber.

Scrubber Sludge

Waste disposal is another major concern. Scrubbers generate large quantities of sludge that has a high water content. Sludges high in calcium sulfite are particularly troublesome because they are difficult to dewater and can return to a semi-liquid state when agitated. Sludge that is not carefully treated and disposed can, therefore, become a source of groundwater pollution.

Utilities have normally stabilized the sludge by mixing it with fly ash and then disposing of the wastes in a settling pond. Ponding operations, however, are undesirable because trace elements and dissolved salts in the sludge may leach into groundwater. The sludge should first be treated to stabilize it. Ponds should also be lined with an impervious material.

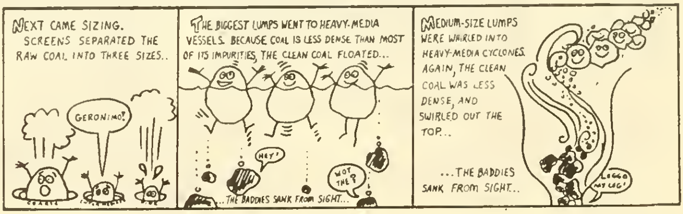
Today, the most prominant sludge disposal process is the Poz-O-Tec® process marketed by IU Conversion Systems. The sludge is first dewatered and then mixed with fly ash, lime, and chemical additives. A structurally stable material that doesn't breakdown chemically is produced. It can then be stored in a landfill.

To improve sludge management, the US Environmental Protection Agency (US EPA) has been testing a process that oxidizes the sludge. Oxidation converts the calcium sulfite to calcium sulfate, which is easier to dewater for handling and storage. The calcium sulfate (gypsum) can then be used in wallboard manufacturing.

Successful Scrubbers

Several utilities have successfully operated scrubber systems at power plants that burn high sulfur coal. At Southern Indiana Gas & Electric's A.B. Brown Station, a dual alkali system is used to remove sulfur dioxide emissions from coal that

DEJECTED, THEY WAITED IN A STOCKPILE FOR WEEKS...
AND WEEKS...
UNTIL, ONE DAY...
CLEAN 'EM UP!!
THE ORDEAL BEGAN WITH SIZE REDUCTION — BREAKERS AND CRUSHERS KNOCKED OFF THE LARGEST IMPURITIES AND EXPOSED HIDDEN ONES...
LUMPS ON MY LUMPS!


NEXT CAME SIZING. SCREENS SEPARATED THE RAW COAL INTO THREE SIZES..
GERONIMO!
THE BIGGEST LUMPS WENT TO HEAVY-MEDIA VESSELS. BECAUSE COAL IS LESS DENSE THAN MOST OF ITS IMPURITIES, THE CLEAN COAL FLOATED...
HEY!
WOT THE?
...THE BADDIES SANK FROM SIGHT...
MEDIUM-SIZE LUMPS WERE WHIRLED INTO HEAVY-MEDIA CYCLONES. AGAIN, THE CLEAN COAL WAS LESS DENSE, AND SWIRLED OUT THE TOP...
...THE BADDIES SANK FROM SIGHT...
LEGGO MY LEG!

averages a sulfur content of 3.3%. In the dual alkali system, sulfur dioxide is first reacted with a sodium solution made with soda ash. Then the solution is mixed with lime in a holding tank in which the waste products are formed. This method reduces the formation of scale in the scrubber. The dual alkali system scrubber at the A B Brown Station has performed very well during its first year of operation. Sulfur dioxide removal efficiencies of over 90% have been achieved.

It should be mentioned that another dual alkali system, constructed at Central Illinois Light Company's Newton Station, has experienced some operating problems. The major difficulty is related to the high chloride content of the coal burned at the station. Chlorides corrode the metal surfaces in the scrubber. Chlorides also disrupt the process chemistry in a dual alkali system because the chlorides react with the alkali thus decreasing the amount of alkali available to react with the sulfur dioxide. Such reactions lower the sulfur dioxide removal efficiency of the scrubber and consequently require the use of more alkali, which can be very expensive.

To combat these problems, the utility installed a small prescrubber that removes chloride. Some other modifications have been made as well. The performance of the system has improved in the past several months, but the scrubber is not yet fully dependable. The utility is continuing to work on the problems.

Another successful scrubber system is operating at Pennsylvania Power's Bruce Mansfield Station. This scrubber experienced severe problems at first. Major modifications were made on the demisters and stack lining. The utility also revised its process control instrumentation. Reliability of the scrubber system has improved significantly. The scrubber has achieved sulfur dioxide removal efficiencies between 90% and 95%.

Pennsylvania Power is presently debugging a third scrubber system that has recently gone into commercial operation at the Bruce Mansfield Station. This scrubber is different from the earlier system because it uses a horizontal absorption chamber. Magnesium is also added to promote the absorption of sulfur dioxide by the alkali.

Recent Developments

There are several new scrubber developments that show great promise. First, US EPA has been adding adipic acid to the limestone slurry in a pilot plant scrubber. In experiments, adipic acid increased sulfur dioxide removal efficiencies of the scrubber to 95%. Further tests at a utility scrubber are in progress.

Second, the Electric Power Research Institute (EPRI) has been promoting a scrubber that bubbles flue gas into a reactor containing a limestone slurry. The sulfur doixide is absorbed and subsequently oxidized to form gypsum. The system has demonstrated good reliability and high sulfur dioxide removal efficiencies at the pilot plant stage. EPRI would like a utility that burns medium to high sulfur coal to provide a site for a demonstration project. Unfortunately little interest has been shown by utilities in the Midwest.

Finally, Argonne National Laboratory is installing a scrubber at a boiler that will burn 3.5% sulfur coal. The system, known as a dry scrubber, consists of a spray dryer and "baghouse" fabric filter. Minute droplets of lime slurry will be sprayed into the hot gas, cooling it and reacting with the sulfur dioxide to form a dry powder. The powder will then be collected in a fabric filter and disposed in a landfill.

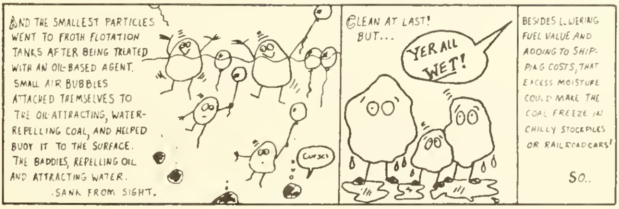
References

1 Kilgroe JD (US Environmental Protection Agency) Coal Cleaning for Sulfur Oxide Emission Control. Paper presented to Acid Rain Conference, Springfield, VA, April 8, 9, 1980

2 Hopkins ME, Simon JA *Coal Resources of Illinois. Illinois Minerals Note 53* Illinois State Geological Survey, January 1974

3 Helfinstine et al *Sulfur Reduction of Illinois Coals—Washability Studies, Part 1* Circular 462, Illinois State Geological Survey, 1971

4 More Coal Per Ton *Electric Power Research Institute Journal* 4(5) 7, June 1979

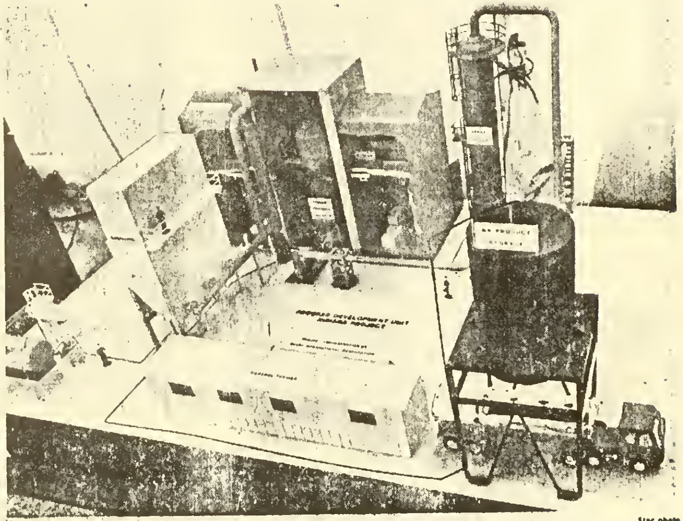

AND THE SMALLEST PARTICLES WENT TO FROTH FLOTATION TANKS AFTER BEING TREATED WITH AN OIL-BASED AGENT. SMALL AIR BUBBLES ATTACHED THEMSELVES TO THE OIL-ATTRACTING, WATER-REPELLING COAL, AND HELPED BUOY IT TO THE SURFACE. THE BADDIES, REPELLING OIL AND ATTRACTING WATER. .SANK FROM SIGHT.
Curses
CLEAN AT LAST! BUT...
YER ALL WET!
BESIDES LOWERING FUEL VALUE AND ADDING TO SHIPPING COSTS, THAT EXCESS MOISTURE COULD MAKE THE COAL FREEZE IN CHILLY STOCKPILES OR RAILROADCARS!
SO..

SOME COAL WAS DRIED ON VIBRATING SCREENS. .
SOME IN CENTRIFUGES.
SOME BY THERMAL DRYERS.
FINALLY, CLEAN AND DRY, THE COAL FROM OLD DIRTY PASSED MUSTER..
LOOKIN' GOOD!
GRADE A ILLINOIS
LOW SULFUR
LOW ASH
UNIT #3 — HERE WE COME!
The End

INDIANAPOLIS STAR 1-84

October completion date

Coal processing facility dedicated


Star photo

Model of technical, dry coal-scrubbing unit to be built and tested by IPL

Test project to cost $6.2 million and testing to last 18 months at Stout Plant

By DAVID KNIGHT

The city's largest utility broke ground Thursday for construction and testing of a dry scrubbing process for coal that may reduce harmful sulfur and nitrogen dioxide emissions by as much as 90 percent.

Indianapolis Power and Light Co. will test the electron beam irradiation process in one of its smokestacks at its Stout Plant, 2700 South Harding Street.

The dry scrubber was developed by EBARA International Corp. of Japan, which has a subsidiary in Greensburg, Pa. EBARA will construct and manage the project.

THE CONSTRUCTION of the scrubber is to start in April and has an October completion date. Testing is expected to last 18 months.

Lt Gov. John M Mutz emceed the ground-breaking ceremonies under a tent at the site.

Various representatives of the coal, gas and fertilizer industries, the Indiana Energy Development Board and a sprinkling of members from the Indiana General Assembly joined others in the ground-breaking.

The test project is expected to cost $6.2 million. More than 50 percent of the cost is being underwritten by the U.S. Department of Energy, and EBARA will spend about 25 percent, or about $1.5 million.

OTHERS PARTICIPATING in the testing are the Indiana Energy Development Board, Indiana Electrical Association-Member Companies, AMAX Coal Co. and C F Industries.

"The project holds great promise in two very important public policy issues," said Mutz, who turned the first shovelful of dirt on the sunny, crisp afternoon. "How can we make it possible to mine and sell more Indiana coal, and how can we make sure emissions in general at stations are free from nitrate and sulfur oxides?"

Mutz also said he hoped the new method will prove to be less expensive "than coal scrubbing processes used elsewhere."

"IT IS IMPORTANT that government and the private sector combine to solve those kinds of problems important to the future of Indiana."

"Now it's our responsibility to make the project work," said Norman Frank, chief executive officer of EBARA.

The process fires an electron beam into the flue gas and adds ammonia at a later stage. The sulfur and nitrogen oxidize, further reacting with ammonia, and form a byproduct of ammonium sulfate and ammonium nitrate sulfates.

The sulfates are then recovered as a dry powder, potentially salable as fertilizer.

FRANK SAID EBARA has spent $10 million to $12 million during a nine- to 10-year period developing the process.

Dr. Sun Chun, director of the DOE's Pittsburgh Energy Technology Center, called the project "a dream come true" that brings together representatives from the state, federal and private sectors.

"This opens up exciting possibilities for the revitalization of the coal industry in Indiana," said Larry Reynolds, president of the United Mine Workers Association, District 11.

"I feel comfortable that the process will work, and a lot of people are to be commended for this."

IF THE TESTING proves positive, it still might be three to five years before the dry scrubber becomes marketable. But if it were marketed, it could help many of Indiana's 1,600 unemployed coal miners return to work.

"It sounds promising," said Walter J. Kulakowski, administrator of the city's Air Pollution Control Division.

IPL earlier this month announced it would add 12 feet to two of its 250-foot high smokestacks at Stout and blend fuels to cut sulfur emissions.

It also had announced it would buy costly low-sulfur coal in other parts of the country rather than use cheaper high-sulfur Indiana coal.

The plan faces an uncertain future because recent court decisions have ruled that raising smokestacks to spread pollution was not enough action to control harmful emissions.

The Izaak Walton League of America
INCORPORATED
DEFENDERS OF SOIL, WOODS, WATERS AND WILDLIFE

Indiana Division

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February 14, 1984

Honorable Henry A. Waxman, Chairman
Subcommittee on Health and the Environment
United States House of Representatives
2415 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Waxman:

Thank you very much for the opportunity to testify at the February 10 hearing in Indianapolis on acid rain control. The Indiana Clean Air Coalition is greatly encouraged by your efforts, along with those of Congressman Sikorski, to help abate the serious problems that Hoosiers are facing due to air pollution and the resulting acid deposition.

The enclosed materials are directed to Mr. Jerry Dodson of the Subcommittee staff for incorporation to the hearing record. They include Table III-3 from the 1982 Pechan & Associates report to the U.S. Environmental Protection Agency, which displays the changes in electric utility sulfur dioxide emissions by state from the years 1976 to 1980. This table shows that over this four-year interval there were declines of 21 to 36 percent for the States of Illinois, Kentucky, Michigan, and Ohio, while Indiana's electric utilities increased their sulfur dioxide output by 7 percent.

Also enclosed are tables from the 1984 Systems Application, Inc. draft final report to U.S.E.P.A. which show the visibility and other air quality benefits to Indiana of sulfur dioxide emission controls, including those resulting from the Waxman-Sikorski bill (H.R. 3400) scenario. These tables consistently show projections of significantly improved visibility when sulfur dioxide emissions are controlled, with Indiana among the states reaping the greatest improvement.

Already deposited with Mr. Dodson is a supply of copies of the special color issue of the German "General Forestry Journal", which was distributed to professional foresters in Germany in 1983 as part of a comprehensive survey of air pollution damage to trees. This document is relevant to Indiana because the same symptoms of tree disease are being seen here. This pamphlet and its English translation from the Natural Resources Defence Council are for the hearing record and for distribution to the Subcommittee members and other interested members of Congress.

We are deeply grateful for your consideration.

Sincerely,

Frederic W. Widlak, Ph.D.

cc: Reps. Sikorski, Coats, Sharp, & McCloskey

THIS LETTERHEAD PRINTED ON RECYCLED PAPER TO SAVE FOREST RESOURCES

Frederic W. Widlak, Ph.D.

PB83-130229

EPA-600/7-82-061a
November 1982

ESTIMATES OF SULFUR OXIDE EMISSIONS FROM THE ELECTRIC UTILITY INDUSTRY

VOLUME I - SUMMARY AND ANALYSIS

by

E.H. Pechan & Associates, Inc.
Springfield, VA 22151

Subcontract Under
University of Illinois Prime Contract
CR809461-01

Office of Environmental Engineering and Technology
U.S. Environmental Protection Agency
Washington, DC 20460

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NATIONAL TECHNICAL
INFORMATION SERVICE
US DEPARTMENT OF COMMERCE
SPRINGFIELD VA 22161

Table III-3

CHANGES IN STATE SO_2 EMISSIONS FROM 1976 TO 1980
(Emissions in 1000 Tons per Year)

State	Rank 1976	1976 Emissions	Rank 1980	1980 Emissions	Change	Percent Change
Alabama	10	704.9	12	543.1	-161.8	-23
Alaska	44	12.8	46	11.7	-1.1	-8
Arizona	29	68.5	27	87.5	19.0	28
Arkansas	35	38.3	41	26.6	-11.7	-31
California	23	151.7	31	77.9	-73.8	-49
Colorado	30	67.9	32	77.5	9.6	14
Connecticut	41	25.2	39	32.1	6.8	27
Delaware	31	60.9	34	52.5	-8.5	-14
District of Columbia	46	7.2	48	4.6	-2.6	-36
Florida	11	673.2	10	725.9	52.6	8
Georgia	13	499.1	9	736.7	237.6	48
Hawaii	34	40.1	36	41.6	1.5	4
Idaho	50	0.0	51	0.0	0.0	0
Illinois	5	1,428.8	5	1,125.6	-303.2	-21
Indiana	3	1,443.1	2	1,539.6	96.5	7
Iowa	19	217.8	18	231.3	13.6	6
Kansas	24	121.1	23	150.1	29.0	24
Kentucky	2	1,512.3	6	1,007.5	-504.7	-33
Louisiana	39	32.9	42	24.8	-8.1	-25
Maine	43	13.0	45	16.3	3.3	26
Maryland	18	218.2	19	223.2	5.0	2
Massachusetts	21	159.6	17	275.5	116.0	73
Michigan	9	887.6	11	565.4	-322.3	-36
Minnesota	16	230.6	21	177.4	-53.2	-23
Mississippi	22	154.1	24	129.2	-24.9	-16
Missouri	7	1,179.4	4	1,140.5	-38.9	-3
Montana	42	16.8	43	23.4	6.6	40
Nebraska	40	27.4	35	49.5	22.1	80
Nevada	38	33.6	37	39.5	5.9	18
New Hampshire	33	50.5	30	80.5	30.0	60
New Jersey	26	113.2	26	110.2	-3.0	-3
New Mexico	27	87.1	28	84.6	-2.6	-3
New York	12	512.8	14	480.3	-32.4	-6
North Carolina	15	410.2	15	435.4	25.2	6
North Dakota	32	58.7	29	82.5	23.8	41
Ohio	1	2,749.8	1	2,171.6	-578.2	-21
Oklahoma	49	0.3	38	37.7	37.4	12,386
Oregon	51	0.0	49	3.3	3.2	48,785
Pennsylvania	4	1,432.0	3	1,466.1	34.1	2
Rhode Island	47	3.0	47	5.2	2.2	73
South Carolina	20	162.2	20	213.1	50.9	31
South Dakota	37	33.9	40	28.6	-5.3	-16
Tennessee	6	1,228.3	8	933.7	-294.7	-24
Texas	25	117.3	16	302.8	185.5	158
Utah	45	12.8	44	22.1	9.3	73

From: "Visibility and Other Air Quality Benefits of Sulfur Dioxide Emission Controls in the Eastern U.S.," Draft Final Report, Systems Application Inc. for EPA, January 6, 1984.

TABLE 6-2 Concluded.

(c) resulting from the Waxman-Sikorski-Bill control scenario.

State	1980 Population	Percent Improvement in Average Visibility*	Economic Value ($$10^6$)
Alabama	3,890,061	8	62.256
Arkansas	2,286,435	1	4.573
Connecticut	3,107,576	7	43.506
Delaware	595,225	11	13.090
District of Columbia	648,000	12	15.552
Florida	9,739,992	1	19.480
Georgia	5,464,265	10	109.280
Illinois	11,418,461	8	182.695
Indiana	5,490,179	12	65.880
Iowa	2,913,387	2	11.652
Kentucky	3,661,433	14	102.508
Louisiana	4,205,900	1	8.412
Maine	1,124,660	4	8.997
Maryland	4,216,446	12	101.195
Massachusetts	5,737,037	6	68.844
Michigan	9,258,344	8	148.128
Minnesota	4,077,148	1	8.154
Mississippi	2,520,638	4	20.165
Missouri	4,346,267	3	26.076
New Hampshire	920,610	5	9.206
New Jersey	7,364,158	9	132.552
New York	17,557,288	8	280.912
North Carolina	5,874,429	12	140.976
Ohio	10,797,419	13	280.722
Pennsylvania	11,866,728	12	284.801
Rhode Island	947,154	7	13.258
South Carolina	3,119,208	10	62.380
Tennessee	3,835,078	11	84.370
Vermont	511,456	5	5.115
Virginia	5,346,279	12	128.304
West Virginia	1,949,644	15	58.488
Wisconsin	4,705,335	3	28.230
Total	159,496,240	7.9 (average)†	2,529.757

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* Improvement over 1995 baseline for the Waxman-Sikorski-Bill SO_2 control scenario.

† Weighted by population.

Table 6. (a) Annual Average Visibility Impairment (Total Light Extinction expressed as /100 km) in each State for the Different SO2 Emission Scenarios and (b) Percent Change from 1980 Baseline for each SO2 Emission Scenario.

State	1980 Baseline	1995 Baseline		10 States Option		12 States Option		12 States with Canadian		31 States 8 million tons		31 States 12 million tons		Waxman/Sikorski Bill	
	(a)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Alabama	24.2	24.3	0	23.7	-2	23.5	-2	23.6	-2	22.5	-6	21.8	-9	22.7	-5
Arkansas	23.8	23.8	0	23.7	0	23.6	0	23.6	0	23.3	-2	23.1	-2	23.3	-2
Connecticut	26.2	26.3	0	24.0	-4	23.8	-6	23.6	-6	23.3	-7	22.4	-11	23.6	-6
Delaware	27.4	27.5	0	25.6	-6	25.3	-7	25.2	-8	24.4	-10	23.2	-15	24.8	-9
Georgia	24.1	24.3	0	23.4	-3	23.2	-3	23.2	-3	22.0	-8	21.2	-12	22.4	-7
Illinois	25.6	25.4	0	25.1	-1	24.8	-3	24.7	-3	23.7	-7	23.1	-9	23.6	-7
Indiana	28.8	28.5	0	28.0	-2	26.8	-7	26.7	-7	25.3	-12	24.3	-15	25.5	-11
Iowa	22.2	22.2	0	22.0	0	22.0	0	21.9	0	21.7	-1	21.6	-2	21.8	-1
Kentucky	27.3	27.0	-1	26.3	-3	25.5	-6	25.4	-6	23.7	-13	22.8	-16	24.0	-12
Louisiana	24.4	24.5	0	24.4	0	24.4	0	24.4	0	24.2	0	24.1	-1	24.3	0
Maine	21.5	21.4	0	20.9	-3	20.7	-3	20.6	-4	20.5	-4	20.1	-6	20.6	-4
Maryland	27.8	27.9	0	25.9	-7	25.4	-8	25.3	-9	24.5	-11	23.3	-16	24.9	-10
Massachusetts	25.0	25.0	0	23.9	-4	23.7	-5	23.6	-6	23.3	-7	22.4	-10	23.6	-6
Michigan	24.9	25.0	0	24.5	-1	24.1	-3	24.0	-3	23.5	-6	23.0	-7	23.6	-6
Minnesota	21.0	21.0	0	20.9	0	20.9	0	20.7	-1	20.8	0	20.6	-1	20.8	0
Mississippi	23.8	23.9	0	23.7	0	23.6	0	23.6	0	23.1	-2	22.8	-4	23.2	-2
Missouri	23.6	23.5	0	23.4	0	23.3	-1	23.3	-1	22.8	-3	22.6	-4	22.8	-3
New Hamsphire	22.7	22.5	0	21.7	-4	21.6	-5	21.4	-5	21.3	-6	20.8	-8	21.4	-5
New Jersey	26.5	26.7	0	25.0	-5	24.7	-6	24.6	-6	24.1	-8	22.9	-13	24.4	-7
New York	25.4	25.3	0	24.2	-4	23.9	-5	23.6	-6	23.5	-7	22.7	-10	23.7	-6
North Carolina	26.6	26.8	0	25.4	-4	25.0	-6	24.9	-6	23.6	-10	22.5	-15	24.2	-9
Ohio	29.9	29.9	0	28.5	-4	27.4	-8	27.4	-8	26.1	-12	25.0	-16	26.4	-11
Pennsylvania	28.6	28.8	0	26.7	-6	26.1	-8	26.0	-9	25.4	-11	24.3	-15	25.6	-10
Rhode Island	25.1	25.1	0	23.9	-4	23.7	-5	23.6	-6	23.2	-7	22.4	-10	23.5	-6
South Carolina	25.2	25.4	0	24.3	-3	24.0	-4	23.9	-5	22.7	-9	21.8	-13	23.1	-8
Tennessee	25.3	25.1	0	24.5	-3	24.1	-4	24.1	-4	22.6	-10	21.8	-13	22.8	-9
Vermont	23.2	23.0	0	22.2	-4	22.0	-5	21.8	-6	21.7	-6	21.1	-9	21.8	-6
Virginia	26.9	27.1	0	25.4	-5	24.9	-7	24.9	-7	23.7	-11	22.5	-16	24.2	-10
West Virginia	28.2	28.3	0	26.4	-6	25.7	-8	25.7	-8	24.4	-13	23.2	-17	24.7	-12
Wisconsin	22.6	22.8	0	22.5	0	22.4	-1	22.3	-1	21.9	-3	21.6	-4	22.0	-2

Table 7. (a) Annual Average Visibility Impairment (expressed as Visual Range in km) in each State for the Different SO2 Emission Scenarios and (b) Percent Change from 1980 Baseline for each SO2 Emission Scenario.

State	1980 Baseline	1995 Baseline		10 States Option		12 States Option		12 States with Canadian		31 States 8 million tons		31 States 12 million tons		Waxman/Sikorski Bill	
	(a)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Alabama	16.2	16.1	0	16.5	2	16.7	2	16.7	2	17.4	7	17.9	10	17.2	6
Arkansas	16.5	16.5	0	16.5	0	16.6	0	16.6	0	16.8	2	17.0	3	16.8	2
Connecticut	15.5	15.4	0	16.3	4	16.5	6	16.6	6	16.8	8	17.5	12	16.6	6
Delaware	14.3	14.2	0	15.3	6	15.5	8	15.5	8	16.0	12	16.8	17	15.8	10
Georgia	16.2	16.1	0	16.7	3	16.9	3	16.9	4	17.8	9	18.5	13	17.5	7
Illinois	15.3	15.4	0	15.6	1	15.8	3	15.8	3	16.5	8	16.9	10	16.6	8
Indiana	13.6	13.7	0	14.0	2	14.6	7	14.7	7	15.5	13	16.1	18	15.4	13
Iowa	17.7	17.7	0	17.8	0	17.8	0	17.9	0	18.0	1	18.2	2	18.0	1
Kentucky	14.4	14.5	1	14.9	3	15.4	7	15.4	7	16.5	15	17.2	19	16.3	13
Louisiana	16.0	16.0	0	16.0	0	16.0	0	16.0	0	16.1	0	16.2	1	16.1	0
Maine	18.2	18.3	0	18.8	3	18.9	3	19.0	4	19.1	4	19.4	6	19.0	4
Maryland	14.1	14.0	0	15.1	7	15.4	9	15.4	9	16.0	13	16.8	19	15.7	11
Massachusetts	15.6	15.7	0	16.4	4	16.5	5	16.6	6	16.8	7	17.5	11	16.6	6
Michigan	15.8	15.7	0	16.0	1	16.3	3	16.4	3	16.7	5	17.0	7	16.6	5
Minnesota	18.6	18.6	0	18.7	0	18.7	0	18.9	1	18.8	1	19.0	1	18.8	1
Mississippi	16.5	16.4	0	16.5	0	16.6	0	16.6	0	17.0	2	17.2	4	16.9	2
Missouri	16.6	16.6	0	16.7	0	16.8	1	16.8	1	17.2	3	17.4	4	17.2	3
New Hamsphire	17.2	17.4	0	18.0	4	18.1	5	18.3	6	18.4	6	18.8	9	18.3	5
New Jersey	14.8	14.7	0	15.6	5	15.8	6	15.9	7	16.3	9	17.1	15	16.1	8
New York	15.5	15.5	0	16.2	4	16.4	6	16.6	7	16.7	8	17.3	11	16.6	7
North Carolina	14.7	14.6	0	15.4	4	15.7	6	15.7	6	16.6	12	17.4	17	16.2	9
Ohio	13.1	13.1	0	13.7	4	14.3	8	14.3	9	15.0	14	15.6	19	14.8	13
Pennsylvania	13.7	13.6	0	14.7	7	15.0	9	15.1	10	15.5	12	16.2	17	15.3	11
Rhode Island	15.6	15.6	0	16.4	4	16.5	5	16.6	6	16.8	7	17.5	12	16.6	6
South Carolina	15.5	15.4	0	16.1	3	16.3	5	16.4	5	17.2	11	18.0	15	16.9	8
Tennessee	15.5	15.6	0	16.0	3	16.3	5	16.3	5	17.3	11	17.9	15	17.1	10
Vermont	16.8	17.0	0	17.7	4	17.8	5	18.0	6	18.0	7	18.5	9	17.9	6
Virginia	14.5	14.5	0	15.4	5	15.7	7	15.7	8	16.5	13	17.4	19	16.2	11
West Virginia	13.9	13.8	0	14.8	6	15.2	9	15.2	9	16.1	15	16.9	21	15.9	14
Wisconsin	17.3	17.2	0	17.4	0	17.5	0	17.6	1	17.9	3	18.1	4	17.8	2

Table 12. Annual Average Human Experience of Visibility Impairment (Sulfate Light Extinction expressed as million person/100 km) in each State for the Different SO2 Emission Scenarios and (b) Percent Change from 1980 Baseline for each SO2 Emission Scenario.

State	1980 Baseline	1995 Baseline		10 States Option		12 States Option		12 States with Canadian		31 States 8 million tons		31 States 12 million tons		Waxman/Sikorski Bill	
	(a)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Alabama	21.7	22.3	2	20.2	-7	19.6	-9	19.5	-10	16.3	-25	14.2	-34	17.0	-21
Arkansas	6.7	6.7	0	6.7	0	6.6	-2	6.6	-2	6.2	-6	6.1	-9	6.3	-6
Connecticut	15.8	16.0	1	13.4	-14	12.9	-18	12.6	-19	12.0	-23	10.2	-35	12.6	-20
Delaware	9.3	9.4	1	7.6	-18	7.3	-22	7.2	-23	6.4	-30	5.3	-42	6.8	-27
Georgia	32.5	33.4	2	29.4	-9	28.5	-12	28.4	-12	22.7	-30	19.2	-41	24.5	-24
Illinois	78.8	77.5	-1	74.7	-5	71.5	-9	71.1	-9	61.1	-22	56.1	-28	61.3	-22
Indiana	87.8	85.3	-2	81.6	-6	72.0	-17	71.6	-18	60.5	-31	53.0	-39	61.6	-29
Iowa	9.0	9.0	0	8.8	-2	8.7	-3	8.6	-3	8.3	-7	8.0	-10	8.3	-7
Kentucky	21.6	20.9	-3	19.2	-10	17.3	-19	17.3	-20	13.4	-38	11.2	-48	14.1	-34
Louisiana	1.1	1.2	0	1.1	0	1.1	0	1.1	0	1.1	-2	1.1	-3	1.1	-2
Maine	5.6	5.5	-2	4.8	-14	4.7	-17	4.5	-19	4.4	-21	3.9	-29	4.6	-18
Maryland	54.6	54.4	0	43.5	-20	41.3	-24	40.8	-25	36.4	-33	30.2	-44	38.6	-29
Massachusetts	48.8	48.3	0	41.5	-14	40.1	-17	39.2	-19	37.5	-23	31.9	-34	39.1	-19
Michigan	76.7	77.6	1	71.2	-7	65.4	-14	64.3	-16	58.5	-23	52.0	-32	59.7	-22
Minnesota	12.3	12.3	0	12.1	-1	12.0	-2	11.3	-8	11.7	-4	11.4	-7	11.8	-4
Mississippi	17.0	17.4	2	16.8	-1	16.4	-3	16.4	-3	15.1	-11	14.2	-16	15.2	-10
Missouri	23.2	22.6	-2	22.4	-3	21.9	-5	21.8	-6	19.2	-17	18.3	-21	19.1	-17
New Hamsphire	5.5	5.4	-2	4.6	-16	4.4	-19	4.3	-21	4.2	-24	3.6	-33	4.3	-21
New Jersey	64.7	66.2	2	54.3	-16	52.2	-19	51.3	-20	47.6	-26	39.5	-38	49.6	-23
New York	196.8	198.9	1	168.2	-14	161.7	-17	157.6	-19	149.4	-24	127.1	-35	155.2	-21
North Carolina	46.5	47.4	2	40.5	-12	38.2	-17	38.0	-18	30.9	-33	25.1	-46	33.6	-27
Ohio	112.6	112.9	0	99.5	-11	88.4	-21	87.4	-22	75.4	-33	64.3	-42	78.0	-30
Pennsylvania	96.3	98.7	2	78.1	-18	73.1	-24	71.8	-25	65.8	-31	55.2	-42	67.9	-29
Rhode Island	3.8	3.8	1	3.2	-14	3.1	-17	3.1	-19	2.9	-23	2.5	-34	3.1	-19
South Carolina	22.4	22.9	2	19.8	-11	18.9	-15	18.9	-15	15.4	-31	12.8	-42	16.6	-25
Tennessee	24.7	24.0	-2	22.2	-10	20.8	-15	20.8	-15	16.3	-34	13.9	-43	17.1	-30
Vermont	2.7	2.6	-2	2.2	-16	2.1	-19	2.1	-22	2.0	-24	1.8	-33	2.1	-22
Virginia	38.5	39.2	1	32.4	-15	30.6	-20	30.4	-21	25.6	-33	20.8	-45	27.7	-27
West Virginia	18.4	18.7	1	15.3	-16	14.0	-23	13.9	-24	11.5	-37	9.4	-48	12.1	-34
Wisconsin	27.7	28.7	3	27.0	-2	26.4	-4	26.1	-5	23.2	-16	21.4	-22	23.9	-13

Table 13. Annual Average Human Experience of Visibility Impairment (Total Light Extinction expressed as million person/100 km) in each State for the Different SO2 Emission Scenarios and (b) Percent Change from 1980 Baseline for each SO2 Emission Scenario.

State	1980 Baseline	1995 Baseline		10 States Option		12 States Option		12 States with Canadian		31 States 8 million tons		31 States 12 million tons		Waxman/Sikorski Bill	
	(a)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Alabama	69.7	70.3	0	68.2	-2	67.5	-3	67.5	-3	64.3	-7	62.2	-10	65.0	-6
Arkansas	21.8	21.8	0	21.7	0	21.6	0	21.6	0	21.3	-2	21.1	-2	21.3	-2
Connecticut	49.8	50.1	0	47.5	-4	47.0	-5	46.7	-6	46.1	-7	44.2	-11	46.7	-6
Delaware	26.1	26.2	0	24.4	-6	24.0	-7	23.9	-8	23.2	-10	22.1	-15	23.5	-9
Georgia	101.3	102.1	0	98.1	-3	97.2	-3	97.2	-4	91.4	-9	87.9	-13	93.2	-7
Illinois	243.8	242.5	0	239.7	-1	236.6	-2	236.1	-3	226.1	-7	221.1	-9	226.3	-7
Indiana	238.8	236.4	-1	232.7	-2	223.1	-6	222.7	-6	211.6	-11	204.1	-14	212.7	-10
Iowa	34.6	34.7	0	34.4	0	34.3	0	34.3	-1	33.9	-2	33.7	-2	34.0	-1
Kentucky	60.8	60.2	-1	58.5	-3	56.6	-7	56.5	-7	52.6	-13	50.5	-17	53.3	-12
Louisiana	3.7	3.7	0	3.7	0	3.7	0	3.7	0	3.7	0	3.7	-1	3.7	0
Maine	22.2	22.1	0	21.4	-3	21.3	-4	21.1	-4	21.0	-5	20.6	-7	21.2	-4
Maryland	150.8	150.5	0	139.7	-7	137.5	-8	136.9	-9	132.5	-12	126.3	-16	134.7	-10
Massachusetts	159.4	158.9	0	152.1	-4	150.8	-5	149.8	-5	148.2	-7	142.5	-10	149.7	-6
Michigan	233.2	234.1	0	227.8	-2	222.0	-4	220.9	-6	215.1	-7	208.6	-10	216.3	-7
Minnesota	56.8	56.9	0	56.7	0	56.6	0	55.9	-1	56.3	0	55.9	-1	56.3	0
Mississippi	58.3	58.7	0	58.1	0	57.7	-1	57.7	-1	56.4	-3	55.5	-4	56.5	-3
Missouri	74.0	73.4	0	73.2	-1	72.6	-1	72.6	-1	70.0	-5	69.1	-6	69.9	-5
New Hamsphire	19.4	19.2	0	18.5	-4	18.3	-5	18.2	-6	18.0	-6	17.5	-9	18.2	-6
New Jersey	186.9	188.4	0	176.4	-5	174.3	-6	173.5	-7	169.7	-9	161.7	-13	171.7	-8
New York	586.7	588.8	0	558.1	-4	551.7	-5	547.6	-6	539.3	-8	517.1	-11	545.1	-7
North Carolina	132.5	133.4	0	126.6	-4	124.3	-6	124.1	-6	116.9	-11	111.1	-16	119.6	-9
Ohio	301.4	301.7	0	288.3	-4	277.2	-8	276.2	-8	264.2	-12	253.1	-16	266.8	-11
Pennsylvania	259.5	261.8	0	241.2	-7	236.2	-8	234.9	-9	228.9	-11	218.3	-15	231.0	-10
Rhode Island	12.2	12.3	0	11.7	-4	11.6	-5	11.5	-6	11.3	-7	10.9	-10	11.5	-6
South Carolina	67.2	67.8	0	64.6	-3	63.8	-5	63.7	-5	60.2	-10	57.6	-14	61.4	-8
Tennessee	74.3	73.6	0	71.8	-3	70.4	-5	70.4	-5	65.8	-11	63.5	-14	66.6	-10
Vermont	9.6	9.5	0	9.1	-4	9.0	-5	9.0	-6	8.9	-6	8.7	-9	9.0	-6
Virginia	110.1	110.8	0	104.1	-5	102.2	-7	102.0	-7	97.2	-11	92.4	-16	99.3	-9
West Virginia	50.6	50.8	0	47.5	-6	46.2	-8	46.1	-8	43.6	-13	41.6	-17	44.3	-12
Wisconsin	100.1	101.1	0	99.5	0	98.9	-1	98.5	-1	95.7	-4	93.8	-6	96.3	-3

Mr. WAXMAN. Thank you very much, Mr. Widlak, and I want you to know we're pleased to receive those additional documents you've mentioned in your testimony. We'll add them to the documents that will be made available to the members of the committee.

Let me thank each of you for your testimony. I want to commend you all for the testimony that you've given us, because I think you've presented a perspective of the health consequences, the environmental consequences, and all that is at stake as we evaluate this legislation.

I just want to ask one very quick question of Dr. Jay from the health perspective, since he's testified as a physician on the pollutants that cause acid rain.

If we look at one of the recommendations that's before us from the Reagan administration, that we lime the lakes as a way of trying to mitigate the damages from acid rain, what would that do, in terms of the consequences you pointed out, from a health perspective?

Dr. JAY. Well, I'm a pulmonary physician and not a limnologist, I guess, but I really don't have expertise in that area.

I think that most of the researchers in this area feel that the prime way to get at the health problems and reduce the health risks is by reducing emissions, a direct effect.

The testimony I've presented, in writing and the table, indicates that short-term increases in SO_2 are very, very common; not only in Indianapolis, but in other communities around the country. And it has been shown that there is a relationship between the short-term peaks and the overall annual mean values of SO_2. So that if you decrease emissions, you decrease both the peaks as well as the mean concentrations of SO_2 over time. So most people feel that the most direct way to reduce the health risks from SO_2 is to decrease emissions.

Mr. WAXMAN. I think that point is very well taken, and an obvious one. While liming lakes may temporarily avoid some damage to the lakes, it certainly doesn't do much for the health of people who are breathing in these pollutants. It's sort of like a miner taking a canary down into a mine to see how dangerous it is, and then putting the canary in an oxygen tent. They're obviously not going to see anything from that at all. I thank you very much for that.

Mr. Sharp.

Mr. SHARP. My only question: You mentioned several—the regular monitoring of the air which we have, but I wonder if you can give us any indication of the actual study and the documentation that's going on in terms of the damage to forests, crops, and lakes here in Indiana.

Most people in Indiana, as you know—the general discussion has been about the impact somewhere else, as if we shoot it all up high in the air and it blows to New England, or to Canada, and that's where the impact is. Most of you have identified the ambient air situation; but what kind of documentation is going on with respect to the land, the crops, and the water here in Indiana? Mr. Widlak.

Mr. WIDLAK. Congressman Sharp, if I may begin to answer that question, Dr. Ourie Louchs, of Butler University's Holcomb Research Institute, has just deposited with the committee reports of his study of effects on forests and other vegetation in the Ohio River Valley. So, that documentation has just been submitted to you.

Mr. SILVER. He is unfortunately not able to be with us today. But that specific study shows abnormal foliage, narrower growth rings, and mortality being observed, in central Indiana, from this acidic sulfate aerosols.

Mr. SHARP. Thank you, Mr. Chairman.

Mr. WAXMAN. Thank you very much, Mr. Sharp.

Mr. Coats.

Mr. COATS. Yes, as the token Republican on the panel, I feel obligated that I add that what the Reagan administration is proposing is not just liming the lakes, a $5 million mitigation program, but, also a considerable acceleration of research funds. In fact, yesterday I voted on the House floor and we passed, by a substantial margin, a bill to double EPA's acid rain research budget to $35 million for fiscal year 1985. And I'm a strong supporter of the President's proposed budget that deals with acid rain: $55.5 million total in research, $5 million for mitigation, and $67 million in control technology research. So, we're talking about nearly $130 million, which is a substantial increase.

This is an issue that cuts across party lines and I don't know anyone that says we should do nothing. Acid rain is a problem. We do need to do something. The question is: What do we do, and how do we do it, and what impact will it have. However, let's make sure we have all the facts in before we embark on expensive control strategies.

Dr. Jay, I just have one question for you. You spoke and have done some impressive research in terms of the effects of sulfur dioxide on health. You didn't mention anything about nitrogen oxide, and there's been considerable evidence to suggest that part of our problem results from nitrogens of oxide. Can you indicate any studies you've done, or any information you have regarding the effects of nitrogen oxide on health, and what percentage, or what role that plays in this whole question?

Dr. JAY. The time constraint led me to deal with the predominate issue of SO_2. Clearly, NO_2 and other oxides of nitrogen have, under varying circumstances, adverse effects on health.

The American Lung Association, in some extensive compilations of the research worldwide in the area of ambient air pollution, has compiled many, many articles. I heard a quote earlier of something like 6,000 or so that deal with the health effects of all pollutants, including NO_2. So, it clearly, under a variety of circumstances, may have an adverse effect on respiratory health.

Mr. COATS. And that's caused by automobile exhaust, is that correct?

Dr. JAY. That is primarily caused by automobile exhaust.

Mr. COATS. So, by putting scrubbers on smoke stacks in Indiana we're not doing anything to mitigate the NO_x emissions.

Dr. JAY. Ninety percent of the problem is SO_2; 10 percent, perhaps, is NO_2. So that, while we would be dealing in this legislation, I think, with the predominate part of the problem, we would not necessarily be affecting the other pollutants that are known to cause adverse effects on health.

But, I think, the predominate effect of this legislation would be to attack the major existing problem.

Mr. Coats. Thank you. While I still have time, Mr. Silver, you indicated that the Sierra Club supports H.R. 3400 but also, with amendments. What kind of amendments do you have in mind?

Mr. Silver. We looked at a caucus resolution from the northeastern Congressmen that was passed and is a bill, H.R. 4404, which increases the 10-million ton SO_2 reduction to 12 million tons.

Mr. Coats. So, you want a 50-percent increase in control over what the Waxman-Sikorski bill proposes?

Mr. Silver. We want an increase over what Waxman- Sikorski—we believe in Waxman-Sikorski, but we'd like to see it going faster, yes.

Mr. Coats. Which would then result in higher costs and greater increase per ratepayer than what you indicated in your testimony if the amendment you propose were adopted.

Mr. Silver. I haven't seen any studies to say that if we'd reduced another 2 million tons that it would increase utility rates. I have not seen that.

Mr. Coats. Is it correct to say then that the official position of the Sierra Club is to support H.R. 3400, but only with those amendments, or——

Mr. Silver. No; we backed off, I think, from the Mitchell bill because it was going to penalize Indiana. And we believed that this bill will not penalize Indiana; in fact, it will be a fair cost-sharing basis. And, therefore, we have gotten off that other bill, and we are pushing the Waxman-Sikorski bill.

Mr. Coats. Will you accept it as written, without amendments?

Mr. Silver. As far as I know, yes.

Mr. Coats. Thank you.

Thank you, Mr. Chairman.

Mr. Waxman. Thank you, Mr. Coats.

Mr. Sikorski.

Mr. Sikorski. Mr. Chairman, on that—I think I want to get on with the testimony—but I think there are two points that have to be cleared up for the record, and for the people here.

First of all, the distinguished member from Indiana raises a very important problem, and that's the focus on NOx. Until our legislation came forward, NO_x was kind of a forgotten child in the acid rain debate. In fact, for parts of the country with snow, and that includes Indiana, NO_x is an important part, because of the melt, in the increased effect.

And this legislation, H.R. 3400, has provisions that will clean up 4 million tons annually of nitrogen oxides. So, this would be the legislation to embrace if concerned about the NO_x.

Second, on the Reagan administration's approach to acid rain, he can't get away with what he's doing. And the research and development money, the so-called increase, is merely an attempt to restore some of the cuts that have been made by the Reagan administration in research efforts in this area.

Second, if you look at the total EPA budget for research and auxiliary budgets for research in the EPA areas, you will see that what's been done is that what's been increased here has been cut elsewhere on studies that are very much a part of the acid rain review.

Just last year we, in Congress, forced the administration to put back on line the last 2 years of a 5-year study, the largest in the world; that it is, in my State, Minnesota, and Wisconsin, and Michigan in conjunction with the Canadians. They weren't going to allow the data to be published, and that was just $200,000. So, there's no sincerity in the research cuts.

On the technology thing, the biggest new technology that people are talking about is the LIMB, the limestone injection multiburner system. And if you look at what they're proposing this year, it's around $9 or $10 million for that system. Last year, Congress forced $10 million spent on it.

Second, when the Reagan people first came in, they cut that by over half. So, we shouldn't feel good about what they're doing. I think what they're doing is good, taken by itself and then in comparison to what's historically happened the last 3 years, but they shouldn't get any merit points for that.

Mr. WAXMAN. Thank you, Mr. Sikorski.

And thank you very much for your participation in this hearing.

We're pleased to now ask to come forward Hon. Robert D. Orr, Governor of the State of Indiana.

I'm delighted to welcome you to our subcommittee hearing today. We look forward to your presentation to us.

STATEMENT OF GOVERNOR ROBERT D. ORR, GOVERNOR, STATE OF INDIANA

Governor ORR. Thank you, Mr. Chairman, and welcome to Indiana. Welcome to those of you who come from elsewhere, and welcome home to Congressman Sharp and Congressman Coats.

It is my pleasure to appear here to outline my own thinking and thoughts on the evident problem of acid rain.

Allow me, before making my comments, to make the point that I have been serving as a part of an acid rain task force of the National Governors' Association, which has most certainly opened the eyes of everyone that is involved in that complex issue.

Congressman McCloskey, I didn't see you sitting over there in the corner, and my apologies to you.

Mr. McCLOSKEY. I'm glad I'm welcome, too, sir.

Governor ORR. Inasmuch as I am a resident of the Eighth Congressional District, I should have recognized you first, I presume.

I bid welcome to all of you. I am grateful for this opportunity to testify on the important subject of acid rain legislation.

As a major coal producing and consuming State, Indiana has a vital interest in the proposed acid rain legislation. We're very concerned with the impact such legislation would have on our coal industry, our electric utility industry, our efforts to create new jobs through economic development, and, most important, the impact on electric rate payers.

The State of Indiana is genuinely interested in finding an equitable, long-term solution to acid rain. In fact, in an effort to reduce our sulfur dioxide emissions, in order to further utilize our abundant coal resources, we are funding or participating in research and development of innovative sulfur dioxide and nitrogen oxide emissions control technologies. Examples include the following: Pressurized fluidized-bed combustion technology; supercritical steam stripping of sulfur from coal; and most recently, a unique dry flue gas scrubber developed by the Ebara Corp. of Japan, to be tested at an Indianapolis power and light company generating station here in Indianapolis.

This technology is expected to remove simultaneously both sulfur dioxide and nitrogen oxide in excess of 90 percent, and produce a marketable fertilizer, rather than a sludge, as a byproduct. And let it be understood that a large portion of the funding for that is coming from funds made available by the Indiana General Assembly.

With the help of these new technologies, the next generation of Hoosier coal-fired boilers will be able to meet the new source performance standards of the Clean Air Act.

As the 20th century draws to a close, Indiana and the Nation's sulfur dioxide and nitrogen oxide emissions will continue to decline, particularly when measured in terms of tons of pollutant per unit of electricity. We're proud of the progress so far made in Indiana.

According to an analysis done by the Office of Technology Assessment, if Congress imposes additional controls on existing power plants, electric rate payers across the Nation, from steel mills to homeowners, can expect to pay between $2 billion and $ 5 billion per year, additional.

At issue here is the simple and classic question of cost versus benefit. And that question must be answered in the full context of this issue. Most of the public is unaware that existing Federal law is already in the process of reducing emissions to levels now proposed by acid rain legislation. The question, which H.R. 3400 begs, is: Do we want to force electric utility customers to pay for speeding up this process?

The Electric Power Research Institute has shown that existing controls imposed on power plants, beginning in the early 1970's, have yielded and will continue to yield significant reductions in sulfur dioxide emissions at a cost of about $6 billion a year. Sulfur dioxide emissions will continue to decline. And, by the year 2000, will be only about one-third of what they would have been without these controls.

There is no question that proposed acid rain legislation to extend control measures to the remainder of the Nation's existing coal-fired power plants could decrease sulfur dioxide emissions further, but an additional cost of many billions of dollars would be incurred each year.

Hoosier rate payers would be directly affected by additional control requirements if we assumed that the Acid Deposition Control Fund will be able to pay only the required 90 percent of the capital cost of retrofitting the 50 largest sulfur dioxide emitting plants. The remaining capital and annual operating and maintenance costs will be borne by the rate payers.

Because there are many variables and unknowns, cost forecasts are difficult to calculate with absolute certainty. However, preliminary estimates, by the Indiana State Board of Health, show the annual costs of the remaining capital expenditures and ongoing operation and maintenance to be approximately $300 million, which pays for mandated scrubbers accounting for 716,000 tons of sulfur reductions, 61 percent of the total required reductions under H.R. 3400. Under our estimates, the remaining 455,700 tons would cost rate payers an estimated $370 million annually, making Indiana's total bill, to comply with the provisions of H.R. 3400, $670 million per year. This translates into an incredible $269 average increase per customer. Let me emphasize that these increases would be over and above other rate increases our electric utilities will request for normal operating purposes.

I repeat, the question is: Should electric utility customers be forced to pay for speeding up the process of producing emissions, even though we are already on the road to solving the problem. Furthermore, should we make this investment when experts believe that the next generation of coal-fired plants will offer greater and more cost-effective emissions reductions than now achievable by retrofitting today's plants.

I believe that, in the case of this proposed solution to the acid rain problem, the costs far outweigh the benefits. Should rate payers be forced to bear these costs here in Indiana, and the rest of the Nation's heartland? Have to answer, no.

Unquestionably, acid rain is a problem. In recognition of this, members of my staff and I have spent an enormous amount of time working with the National Governors' Association Task Force on Acid Rain, of which I am a member. As you know, the task force failed to reach an effective consensus on the issue. That experience has shown us that legitimate regional differences, resulting from ongoing scientific uncertainty, continue to militate against a solution that the Nation, as a whole, can endorse. This is why I strongly support President Reagan's call for a doubling of the acid rain research effort.

In the interim, I support aggressive mitigation of acid rain efforts, such as lake liming, to be paid from Federal sources. Additionally, I urge today the implementation of a crash program to fund research and development in the area of enhanced coal-burning technology using the idle resources of the Synthetic Fuel Corp.

As I noted earlier, in Indiana, State government has made the commitment to research and development efforts aimed at reducing sulfur dioxide emissions. Focusing the Synthetic Fuels Corporation on this similar objective would be a positive and welcome signal from Washington that the concern about acid rain is both national and scientific.

I appreciate the opportunity to testify before you today. And offer this testimony in support of the general, best interests and welfare of the 5½ million citizens of the State of Indiana.

I am prepared to respond to such questions as you may have.

[Attachments to Governor Orr's prepared statement follow:]

RATIONALE FOR REFOCUSING THE SYNTHETIC FUELS CORP.

We are all happily aware of the declining world price for oil. The cost for oil imported into the U.S. peaked in 1981 at $37.05 per barrel; today, that same imported barrel would cost less. The latest data from the Department of Energy (based on November 1983 sales) indicates that imported oil costs $29.09 per barrel.

The midrange estimate for the world oil price is projected to fall through the mid 1980's before increasing in the latter half of the decade (perhaps to $37 a barrel in 1990) according to the U.S. Department of Energy.

When the U.S. Government announced its intention to stimulate development of a synthetic fuels industry following the OPEC embargo in 1973, there was a surge of interest by private industry. This interest has all but disappeared as former perceptions of continually increasing oil prices have been reversed by lower prices brought on by the current "oil glut". The original goals of the Synthetic Fuels Production Act of 1980 (500,000 barrels per day of oil equivalent by 1987, 2 million barrels per day by 1992) have become unrealistic in a very short time.

The optimism that surrounded the creation of the Synthetic Fuels Corporation in 1980 has rapidly given way to disenchantment in the face of rising project costs and falling oil prices. In the current environment, even with Government assistance. It is difficult for the private sector to justify major investment in synthetic fuels facitities.

The coal reserve base in the United States is limited more by demand than by supply. The coal reserve base in the U.S. is one of the largest in the world. The most recent estimate puts the nation's reserves at 473 billion tons, of which 246 billion tons are recoverable by conventional mining techniques. 2.24% of American's coal reserves are here in Indiana (10,586 million short tons). Most of this is high-volatile bituminous coal which has a high sulfur content.

Analysis of several acid rain control strategies suggests that the market for high sulfur coal cold be halved, if utilities are ordered to retro-fit their plants. In view of encouraging trends that suggest sulfur emissions are declining as a result of the Clean Air Act and New Source Performance Standards (NSPS), it is appropriate to seek a technological solution that allows us to continue using dependable Indiana coal.

Idle resources of the Synthetic Fuels Corporation are a vehicle to acheive that objective. While there is a place for a Synthetic Fuels industry, it is a long range goal. The assumed cause of acid rain is sulfur emissions from utilities and industrial plants. The scientific evidence is, however, inconclusive. Given the long lead time required for new coal-fired plants (7-9 years) it is necessary to begin now to perfect the cleanest technologies for use under NSPS. The Synthetic Fuels Corporation has the funds to act now, and in the process, will help keep America, and Indiana energy secure.

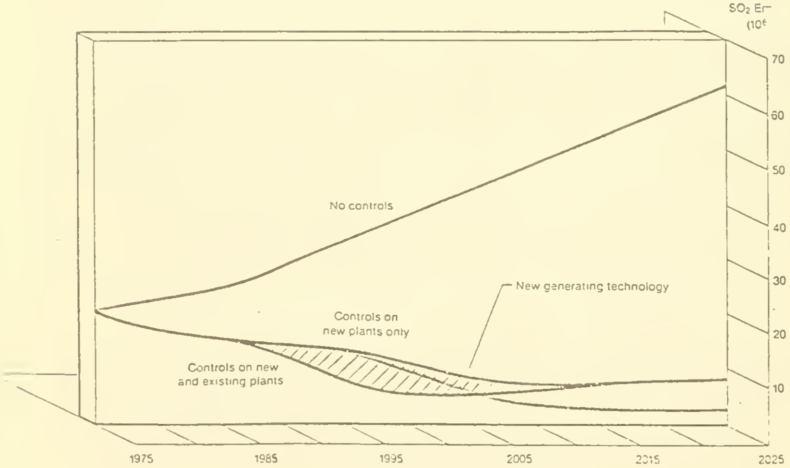
SUMMARY OF GOVERNOR BOB ORR'S ACID RAIN POSITION

The State of Indiana is genuinely interested in finding a long term solution to acid rain. We are heartened that our utility SO_2 emissions fell by 23% on a per megawatt capacity basis between 1975-80. Indiana's total electric generating capacity rose 31.75% during the interim, yet utility SO_2 emissions rose only 1.4%. By the year 2010, 10,600 megawatts of generating capacity will be retired. In preparation for that eventuality, we are funding or participating in research and development of new sulfur/nitrous oxide (NOx) reducing technologies. Examples include: Pressurized Fluidized Bed Combustion (for utility scale applications in 5-10 years), Supercritical Steam Stripping of Coal, and most recently, the 1/26/84 goundbreaking of a unique Flue Gas Scrubber in Indianapolis, which will produce marketable fertilizer rather than sludge as a by-product.

We intend to develop the best technology for use in the next generation of Hoosier coal-fired boilers. As our plants are retired and replaced, New Source Performance Standards (NSPS) within the existing Clean Air Act will substantially cut sulfur and NOx emissions.

As this century closes, utility emissions throughout the nation are expected to continue to decline. If Congress imposes additional controls on existing power plants, the annualized cost to the nation is expected to be in the $3.5 to $6 billion range. By the year 2010, NSPS within the Clean Air Act will have brought total emissions down to the same level. There is a fascinating chart, excerpted below, from the November 1983 edition of the Electric Power Research Institute (EPRI) Journal which warrants close examination. The environmental community agrees with its general conclusions.

U.S. UTILITY EMISSION TRENDS



The chart demonstrates controls imposed on new power plants, beginning in the early 1970's, have yielded significant reductions in SO_2 emissions at a cost of about $6 billion a year. These emissions are continuing to decline, and by the year 2000 are expected to be only about a third of what they would have been without controls. Proposed legislation to extend control measures to the rest of the nation's existing fossil fuel-fired plants could decrease SO_2 further, but at a likely cost (according to EPRI) of $12 billion a year. In 25 years, the next generation of coal plants, based on inherently cleaner technologies, such as those now being supported by Indiana State government, may well offer greater emission reductions than achievable by retrofitting today's plants.

The lines bordering the shaded area on the chart effectively frame today's acid rain debate: should the nation spend +91 billion by the year 2010, to eliminate a problem which by then will have faded away on its own? Candidly, I think not.

It is additionally essential to take note of the National Academy of Sciences' 1983 report ACID DEPOSITION Atmospheric Processes in Eastern North America, which noted "The most reliable data available in a continous record are those from Hubbard Brook (Experimental Forest)"...." the Hubbard Brook record, unlike European data, appears in toto to demonstrate a reduction in sulfate concentration similar to the general reductions in SO_2 emissions." This is a critically important observation, for it affirms the Clean Air Act is working to choke off sulfur emissions. Unfortunately, the same cannot be said for Nitrous Oxide (NOx) emissions.

The National Academy's analysis is important enough to closely scrutinize. The exact language from the report is as follows:

> "Efforts to reconstruct historical trends from the sporadic and disparate data that have been collected in the United States since the late 1950's (Likens and Butler 1981) are beset by large uncertainties (Hansen and Hidy 1982, Stensland and Semonin 1982). The monitoring of precipitation chemistry at the Hubbard Brook Experimental Forest appears to provide the longest continuous record of deposition data at a receptor site in the northeastern United States. These data, as in the European network, were obtained from samples of bulk deposition. The Hubbard Brook samples were collected on a weekly basis, usually with three samples collected simultaneously. We regard the Hubbard Brook bulk-deposition data as reasonably reliable because samples were collected frequently and the collection of several samples at one site permits the detection and elimination of contaminated data.
>
> The Hubbard Brook data reveal several trends (Likens 1980), which are borne out at least qualitatitively in bulk deposition monitoring with relatively unreliable quality control from nine stations in the New York State area (Miles and Yost 1982, Peters 1982):
>
> (1) There has been a decrease in sulfate concentrations since 1964 but an increase in nitrate concentrations over the same time.

(2) An annual pH of precipitation showed no long-term significant change from 1964 to 1977, though several short-term changes did occur.

(3) A linear regression equation of data points from 1964 to 1977 indicates no statistically significant trends in H^+ deposition from 1964 to 1977.

(4) Recent changes in H^+ deposition correspond more with changes in nitrate deposition than with sulfate deposition, even though sulfuric acid is the dominant acid at Hubbard Brook. The contribution of nitrates to total acidity has been increasing, whereas that of sulfates has been decreasing (Galloway and Likens 1981). Year to year changes superimposed on the long-term trend may be related to climatological influences.

"A linear-regression analysis of Hubbard Brook data against time indicates a decline in sulfate concentrations between 1965-66 and 1979-80 of about 33 ± 18 percent (95 percent confidence limits)...

"The Hubbard Brook record, unlike the European data, appears in toto to demostrate a reduction in sulfate concentrations similar to the general reduction in SO_2 emission.

An obvious conclusion to be drawn from the EPRI chart and the Academy's report is that the Clean Air Act is working, and particularly well with respect to sulfur emissions. Additional benefits will accrue when new, efficient plants are brought on line. The existing Clean Air Act must be afforded the opportunity to reap the reductions New Source Performance Standards have ensured.

Acid rain is a compelling problem. It is is heartening to learn that its greatest presumed component (sulfur) is down by perhaps a third in the sensitive Northeast. I support prudent efforts to address acid rain. The President's call for a doubling of our research effort is appropriate. The lessons of that research will be incorporated into practical application as new technologies for use within New Source Performance Standards. In the interim, I support experimental mitigation (such as lake liming) of its effects, to be paid from federal sources. Additionally, I urge today, a crash program in enhanced coal-burning technology using the idle resources of the Synthetic Fuels Corporation (which has languished since world oil prices fell). This may call for a Congressional refocusing of the Corporation's Charter.

Acid rain is a complex problem. Because of multiple scientific uncertainties, it defies the tradition of "polluter pays", which is the norm of American environmental law. If Congress opts to amend the Clean Air Act with further emission reductions, it is fair to expect a national willingness to contribute to its clean-up. A millage tax on all electric generation and importation is fair if Congress acts in the near term. However, reliance on the private sector and NSPS near the end of this century is a more reliable and efficient use of taxpayer's money.

Congress has achieved impressive reductions in industrial, utility and mobile-source emissions under the Clean Air Act. It can look with pride to its achievements in national utility emissions and trends described earlier in my statement. The arduous Congressional negotiations which underpin the existing Clean Air Act balanced environmental aspirations with economic and social realities. The law of diminishing marginal returns still exists. It will be felt by our utilities, their kindred industries and most especially the dependent poor, elderly and all Americans.

It is ironic that Congress is contemplating a course that will cost billions, yet leads to the same conclusion as a less disruptive and more economical alternative. Equally vexing is the possibility that uncertain action now could preclude attractive technologies that hold forth even greater emission reductions in the future.

Mr. WAXMAN. Thank you very much, Governor, for your testimony.

You've indicated that you think that the emissions will be decreasing over the years ahead because new utility plants are required to have scrubbers, and what all acid rain control bills require is that retrofits be put on the existing power plants.

I would like to point out to you that the American Electric Power Industry testified before the U.S. Senate that they don't anticipate phasing out these old power plants and building new ones to replace them in the near future. And that if this is a correct statement, we ought to really expect that the emissions are going to be going up rather than down.

I wanted to point that out to you because it's really of concern to us. If we thought that we could wait and the problem would take care of itself, all of us would be pleased to do that; but if we continue to use these existing power plants and not have that turnover, then we've got to do something about the problem other than just study it. Because we know, now, through all of the studies we've done, if the emissions continue to go up, the problem of acid rain will continue to go up.

Governor ORR. May I respond to that?

Mr. WAXMAN. Certainly.

Governor ORR. My statement had to do with the next generation of powerplants, looking, really, toward the end of this century. I think I identified it on that kind of basis.

Mr. WAXMAN. Well, you indicated that by the year 2000——

Governor ORR. Yes.

Mr. WAXMAN [continuing]. The emissions would drop by one-third.

And we have no indication that that is a fact. In fact, we have every indication that we will not be achieving those reductions by the year 2000, but will see an increase in the amount of emissions, and that new technology that we hope will be promising. The vendors of those new technologies indicate that we will be waiting until the late 1990's before we can see any hope from those technologies.

But I wanted to point out that the Office of Technology Assessment evaluated this claim that there would be a drop by one-third by the year 2000 if we just sit and do nothing, and they don't indicate that they see any scenario where that would take place. So, I wish that you were right, and we'll certainly look at it again.

But if you're not correct, and it seems to me our job will have to be to figure out how to do something, rather than just wait to see if the problem will resolve itself.

Governor, H.R. 3400 has also been thoroughly analyzed by independent analysts, who have said that this bill would cost about $24 to $36 per year for Indiana's residential ratepayers. You've testified that the Indiana Board of Health estimates an incredible $269 average increase per customer. I find that an incredible figure and a great disparity. Now, you may not have the data in front of you, but we'd like to request that you, furnish to us the data that would underpin this statement of yours.

Governor ORR. I'd be happy to supply it. There's an obvious difference, but our technicians do indicate that this is the level of concern that we should have.

Mr. WAXMAN. Well, I would certainly be concerned, if that statement were accurate, that we would be doing far more to the ratepayers in this State than we would feel appropriate. And, so, we want to evaluate whether those statistics are accurate, and compare them to those of the Office of Technology Assessment, and other studies of our bill, to see how and, why they differ; if, in fact, they do differ.

I appreciate your being with us. I want to call on my colleagues for the questions and comments they might have, and I'd like to recognize Congressman Phil Sharp first.

Mr. SHARP. Thank you very much, Mr. Chairman.

And Governor, we're delighted to have you with us, and we appreciate your testimony.

You suggested a proposal of refocusing the Synthetic Fuels Corporation so that its moneys went into the research and development on cleaner burning of coal. I wondered if that proposal is just one the Governor's association has adopted, or is that just a suggestion that you have on the——

Governor ORR. It was a suggestion that came up just recently. As we continue to endeavor to find funds by which we, ourselves, can engage in research—I don't need to make the point to you that, in your own district, Ball State has an energy research function that they're very proud of; Purdue University, likewise—and we have oftentimes had projects which lend some credence to the belief that there could be some mitigation of sulfur dioxide, perhaps even of the elimination of the sulfur from coal before it is burned, rather than afterward. It's been awfully difficult, in many instances, to obtain financing for such experimental projects.

Mr. SHARP. Well, I realize that. In fact, the program, when the FSC was adopted in 1980, it was like the third stage in the Federal assistance in the energy field relating to coal. There's, first, the research and development stage, then the demonstration stage, and both of first two stages have always been funded through the U.S. Department of Energy.

The Synthetic Fuels Corporation was set up for the third stage of the process to try to commercialize, at least, some pioneer plants on a variety of technologies that would effect a variety of resource basis, including coal. As you're probably aware, the Reagan administration's budget has dramatically led, with congressional approval, to the cutting of the first two stages of the budget; research and development and the demonstration projects, which is really the money that you're talking about, which is needed for that purpose.

I think the IPALCO project you mentioned here—I think I'm correct—has the Department of Energy funding associated with that, and I certainly think that's a direction we ought to be going. I, personally, have no difficulty of trying to get some money out of the Synthetic Fuels Corporation and put it there, but I would just stress there are a couple of very practical difficulties with doing that. The Synthetic Fuels Corporation is to act as an investment banker, quite a different function from a granting agency, like the Department of Energy, where we already have the personnel—we did have; we've lost a lot of them—trained, ready to supervise the allocation of funds along the research and development that you're talking about, that's all been cut back. And we may actually cut back the Synthetic Fuels Corporation, but it doesn't—it's not in the habit of granting. The hope was the money would actually, most of it, not have to be spent. We're not sure it will work out that way.

Governor ORR. Well, Congressman, the point I was trying to make is that the Synthetic Fuels Corporation once had a purpose. With the dramatic shift in the price of fuel in various places, it no longer does. It has potentials, and, certainly, in my opinion, there is merit in looking at it as a funding source, to be of assistance, as it once was designed to be, to locate synthetic fuels activities among the states.

Mr. SHARP. Well, I think that's not an unreasonable proposal.

Governor ORR. Rather than just disregarding it, it seems to me that it's worthy of consideration.

Mr. SHARP. Yeah, sure. Well, we're not trying to disregard it. I must tell you, the Synthetic Fuels Corporation is now in its third or fourth solicitation, and that one's going to be of some significance to the coal industry in this country, because it's going to be focused on considering proposals that would lead to gasification or liquification of coal, which, over the long haul, is one way to skin the cat of pollution control, or, at least, diminish it, and still use our coal. So, we want to be a little careful that we don't get at crosspurposes with the direction of the corporation of that. If that were to occur over the long haul, and we were able to develop cheaper, more effective ways to turn coal into gas or liquids, that too, may be the way we burn it in our powerplants, and the way we use it in our pipelines, and whatnot, that could be of use to us.

So, I'm intrigued by your proposal. I can see some practical political difficulties, too, with my ranking Republican member on my subcommittee. Last year, he wanted to put the money into housing, and everybody's got a different place that they want to put it.

Mr. COATS. That's not me.

Mr. SHARP. That's not Dan.

Governor ORR. I knew it wasn't Congressman Coats.

Mr. SHARP. So, we're certainly open to that suggestion of a way of trying to refocus some of the funds. In June, the Corporation will make its report. I think it's now committed to making that deadline as to where we've gotten in synthetic fuels and where we might go. And after that, I think that our subcommittee and others are going to be—we've already started taking a hard look—but take a look at, is there a better way to use the dollars that are already appropriated.

Governor ORR. That was my thought.

Mr. WAXMAN. Thank you, Mr. Sharp.

Mr. Coats.

Mr. COATS. Thank you. I want to make the point that I haven't been around long enough to be ranking on anything.

Governor, thank you for testifying before us. I appreciate your testimony.

I'd like to just pursue one point. I think the most important thing you said or at least the thing that intrigued me the most was the involvement of the State, your administration, the State legislature, with these research and development projects on alternate technologies that might solve our problems.

There's been some concern, of which I share, that, if an acid rain control bill were enacted mandating scrubber technology there would be an adverse impact on other technologies that may provide a better solution to the problem in a shorter timeframe. I wonder if you could comment on that, particularly in light of this new Ebara project with Indianapolis Power & Light.

Governor ORR. I think you hit upon a very important point. We have created in the State of Indiana in the last couple of years the Corporation for Science and Technology, and in 1983, we funded it, and the legislature appropriated $20 million; not a very significant sum in the Federal Government levels, but for the legislature in the State of Indiana a most significant fund. That's to cover a great many different kinds of elements of science and technology, but one of those is to fund some projects, hopefully, that relate to this problem of elimination of sulfur from coal.

It is, in its earliest stages, this Corporation for Science and Technology, made up of its board of directors from people from business, from the academic world, from the governmental world. They are now in the process of receiving proposals. Some of those proposals are also coming from the State's Environmental Management Board—excuse me, the Environmental Development Board, whose many functions encompass those things that might relate to an improvement in the use of various forms of energy with less environmental problem.

What I'm driving at is that, in this administration, we have endeavored to mount an effort from the standpoint of State government, and utilizing State funds, matched with Federal funding, funds from the private sector, funds from wherever we can obtain them that can help us to lead the way out of what, in our opinion, is a very serious set of circumstances. I believe it's important for State government to do those kinds of things; not only for preservation of the environment, but, more particularly, to assure the economic growth, opportunity for jobs, the mitigation of the cost of electric energy for our citizens, all of those things, so that we can move as dramatically and rapidly as possible.

And if we have to divert our effort as well as our funds, to programs which will be only providing medicine to treat the disease rather than a cure for the disease, such as the elimination of sulfur from coal, would tend to indicate to me that we might be spending money ill-advisedly.

So, your point is well taken. Let the States that are affected come up with funds, as we are doing in Indiana, and match them with some Federal funds. But let's direct the research towards the elimination of the problem so that we will not have to spend our money, on a continuing basis, by ratepayers having an increase in the cost of electric energy, and by, incidentally, throwing coal miners out of work, who could be mining coal that could have the sulfur removed from it and converted into useful and environmentally sound fuel.

Mr. WAXMAN. Thank you very much, Mr. Orr.

Mr. Sikorski.

Mr. SIKORSKI. Thank you, Mr. Chairman.

Governor, thank you for the testimony. We want to, as we said in our opening comments, work very closely with you and the other good people to insure that our interests in the Midwest are responded to.

I was interested in your opening comment. You talked about the various concerns and the fact that the State Board of Health was doing some cost estimates. I've seen these figures from every State, but I've never seen them put out by a health department. I was wondering if the Board of Health has looked at the health costs of SO_2 and NO_x. And if they hadn't, they should look at what Dr. Jay testified from the Lung Association earlier. I think it's devastating testimony with regards to the health of the people in Indiana that we're talking about, as well as some of these other concerns. Do you know if they've looked at the health——

Governor ORR. I think it is the responsibility of the Board of Health, in its health functions, to look at things like that all the time. It happens that, in Indiana, our environmental agency is an element of the State Board of Health. That's the reason why the information on this particular matter would have been developed by the State Board of Health. It was developed by the Air Pollution Control Division of the State Board of Health.

Mr. SIKORSKI. You mentioned the polls show that—or that the people say "no" to any costs. The polls that we have, the Harris Poll, a poll done by the Economic Develoment people in New York a year ago, outrageous moneys were asked: "Would you pay $25 more a month" and over a majority of the people said yes, for acid rain control. Harris Poll said they'd pay $100 more in increased taxes, as well as increased utility rates, to clean up acid rain. Of course, what we're talking about here is one-twentieth of that—less than one-twentieth of that because we're not even getting into a formal taxing structure.

The testimony before you this morning was that local TV and newspaper polls, as I understand, also show that, in Indianapolis and other parts of Indiana, people are willing to pay the modest cost of control, and for good reasons. They're breathing in the stuff. It's their lakes. It's their economic resources at risk. I'm wondering if I misheard those people or—I think I just coined a new word—misheard.

Governor ORR. I doubt that you misheard anything.

Mr. SIKORSKI. OK.

Governor ORR. I think that the difference of opinion, quite frequently, is dependent entirely upon the degree of impact. I indicate the degree of impact, based upon information made available to me by our own people, is much more severe than you've indicated in the surveys that have been run. And I think our information indicates that if you have an increase of the nature that you're talking about that the people are not all that sympathetic that would hope that there was another alternative.

Mr. SIKORSKI. I'm sympathetic, as the chairman said, if these figures are correct, we don't want to do that, and we won't do that.

I had a question: You proposed the statement that most of the public is unaware of the existing Federal laws already in the process of reducing emissions to levels now proposed by acid rain legislation. And there was an earlier question with regards to what's going to happen up to the year 2000. The head of or the individual representing—I think he was the vice president—the individual representing the largest private utility in the country testified before the Senate. He said that old plants in service are going to be endeavored to be maintained for just as long as possible; 50, 40 years is what they're talking about. And my personal experience is that, if anything, we have old nuclear plants and new nuclear plants that are made into coal plants, and we don't get rid of these old plants. I think we have to— unless you have some other information, we have to look at what's realistic.

On the technology, two points need to be made. One is, the White House Office assigns some technology as well as the vendors, and the committee has met with the vendors—I wasn't there, it was before my time—of these new technologies, the new burners, and the rest of it, say we can't expect anything before the year 2000. So, to place our hopes to save our health, and our environment, and our economic resources on futures doesn't look very promising.

On top of that, we've had scrubbers around a long time. And what a lot of utilities have done when they put new plants on or made changes, they didn't go to those scrubbers, and they had the option. They built bigger, taller smokestacks. And even if that new technology is available, which it isn't, I'm a little concerned that some of the utilities wouldn't responsibly put it on.

Governor ORR. Well, let me answer that question this way: Having been involved with all of this now for a good many years, both as a member of the legislature, and as Lieutenant Governor, and as Governor, as well as from the standpoint of being a private business person, there was a time when there wasn't any question in anybody's mind that building taller stacks was the easiest solution to the spreading of the various noxious gases throughout the land.

Mr. SIKORSKI. Well, I think there are a lot of questions about that in a lot of people's minds. I think some utilities ignored those questions.

Governor ORR. I'm talking back in 1969, 1970, 1971.

Mr. SIKORSKI. Northern States Power, in Minnesota, did not go the tall smokestack route, it went the scrubber route.

Governor ORR. There were a great many—there was a great deal—a great body of belief, at that time, that this was an appropriate solution to this kind of problem. There were a great many utilities engaged in that; I know a number of them in Indiana did.

That concept has changed. Further scientific evidence indicates, today, that taller smokestacks was very little, if any, help. Which I think underlines one of the genuine concerns that the good people of the State of Indiana have, particularly our coal miners: Scientific evidence today is being used to demand that we do something right now, which may in a few years have been rubbed out of the way, just as tall stacks were some 10 years ago.

Mr. WAXMAN. Gentlemen, yield to me?

Mr. SIKORSKI. Certainly.

Mr. WAXMAN. Governor, I just want to point out a correction of the statement you just made, because I know this is a statement we hear over, and over, and over again from utilities, and it's absolutely untrue. The Congress of the United States said we don't want tall stacks because it's not going to work we've got to put in emission controls. Even the Supreme Court of the United States said we need emission controls under the Clean Air Act. And the utilities went ahead and built these tall stacks and dumped the garbage all over this country. And now, we hear them claiming that the Congress wanted tall stacks as a way of dispersing the emissions. And I think that we're going to find, when we look at the data that underlines this estimate from your department of health, that the information is not accurate, that it came from the same utilities that told us that the tall stacks were going to solve the problem——

Governor ORR. Well, you're saying that——

Mr. WAXMAN [continuing]. And I think we're going to find that they are misleading us all.

Governor ORR [continuing]. You have no belief in our—in the validity of something produced by the State government of the State of Indiana. You say that we take our information from elsewhere?

Mr. WAXMAN. Well, sir, I'm going to look at it very carefully. But they must have looked at the utilities' assumptions because——

Governor ORR. Don't accuse us of taking something or other from some other source, sir, unless you can prove it.

Mr. WAXMAN. Well, Governor, we'll evaluate that.

Governor ORR. All right, fine.

Mr. WAXMAN. And what we want is the facts, and I know that's what you want, too.

Governor ORR. Absolutely.

Mr. WAXMAN. And then, we want to figure out what we can do with that information.

Governor ORR. Absolutely, absolutely. And for a very long period of time, as a member of the Indiana State Senate, the belief was very clearly made to us, from what we thought to be authoritative sources, that building higher stacks would mitigate the problem; not totally, but it would be helpful. And during the period of time, until the scrubbers were developed to the point where they were reliable, that was one of the ways by which the utilities could be of some benefit in terms of mitigating the environmental problem.

Mr. WAXMAN. Well, Governor, Congress said, in 1970, that we didn't want tall stacks. That was part of the Clean Air Act.

Let me point out something else to you. We're going to look at the data that's been furnished. We've had the evaluation by the Office of Technology Assessment, and we have had an evaluation by other independent parties. You will find that, when we evaluate the statistics, they're exactly the same numbers that we get from the utilities. So, I make the assertion, and I'll stand corrected if I'm wrong, that the information that your department has been giving us comes right from the utilities and it's exactly their misrepresentations. We'll look at it together.

Governor ORR. Do you know how we discovered in Indiana, not from Congress; but how we discovered that the tall stacks did no good? We obtained some funds from various sources, including the utilities, and had a study run by our environmental people in the department of health that proved the fact that tall stacks were of no help. But it took us until about 1974 to make sure that that was correct.

Mr. WAXMAN. Well, we know that information clearly now.

Governor ORR. I indicate that simply because I want it understood that here in the State of Indiana we're concerned about these kinds of matters, and we're willing to spend some of our own money to make sure.

Mr. WAXMAN. I commend you for that. The only point I'm trying to make, Governor, is that the utilities who created these tall stacks, notwithstanding the fact that Congress said don't build tall stacks, have turned around and said, "Oh, Congress wanted us to build the tall stacks in order to control these emissions." That isn't what Congress wanted at all. What we wanted was a limit on emissions. And now you're acknowledging that same fact, and we're together on it. The utilities have misrepresented what, in fact, was the history of this situation.

But I've interrupted my colleague here and I don't want to——

Governor ORR. Among those that assisted us in this study were the utilities. And I am, by no means, an enthusiast for a good many of the things that the utilities do. All you have to do is inquire of them here in the State of Indiana, and you'll find that to be the case.

Mr. WAXMAN. Well, then, perhaps if we can show you that they have given you inaccurate information and that the disinterested parties have in their evaluations, given us figures that are more accurate, then you'll see that perhaps we are closer to a solution now than we ever have been before. Because I contend that if we wait until the new technologies come on board, we're talking about the next century before we'll see any——

Governor ORR. It was the case, however, was it now, Mr. Chairman, that the earlier scrubbers were very difficult for anyone to operate on a continuing basis around the clock that they required a continuing maintenance, that many of them did not function well enough for the work that they were supposed to do to be effective.

Mr. WAXMAN. Well, historical footnotes probably do us no good now, but there were scrubbers functioning in the early 1970's. We know that technology can work now, I believe that it's the only technology that will work if we are going to have any control on the acid rain problem before the next century. And, if we wait too long, the damage is going to be irreversible.

Governor ORR. Would you disagree that a massive research effort would be helpful?

Mr. WAXMAN. Well, I think doing research is always very helpful. But I don't think we ought to leave problems to become aggravated while we use research as an excuse to do nothing.

Mr. SIKORSKI. And, Mr. Chairman, it's a good point there. In our bill, we propose that—there's a major section in terms of research, and we allow the States to utilize their best creative judgments in terms of seeking out the 3 million other tons of SO_2 reductions that we need, and we hope that will stimulate. The reason we go to scrubbers in the 50 dirtiest is that we—it's a state of the art today. We know what it can do; we know how much it costs; we know how fast we can get it on line; and those are things we didn't want to minimize.

I wanted to clear up one point on the statement I repeated earlier. Most of the public is unaware that existing Federal laws already in the process reduce emissions to levels now proposed by acid rain legislation; that, somehow, we're asking people to pay a lot of money for something they're going to get anyway. I just haven't had that experience, and I think the recipients of acid rain haven't had that experience either.

Just two examples in the last 3 months: About 3 weeks ago, the current EPA director, relaxed standards for SO_2 emissions for trucks. Is that SO_2 or NO_x?

Ms. **Brown.** NO_x.

Mr. **Sikorski.** NO_x emissions for trucks, the precursor of acid rain.

And a few weeks before that, proposed that the EPA go from its monitoring on a 3-hour average of SO_2 emissions from powerplants to a 30 day average, which is equal to going, say, on your roads in Indiana, that you're going to have a 55-mile speed limit on the average. So, if a person's driving over a day is 55 on the average, it's OK. And that's exactly what would happen to SO_2 emissions. And this is right in the works, and that's what they're proposing. And I don't see any tremendous items that gives me great faith in the SO_2 emissions being reduced in the near future.

Governor **Orr.** Well, Mr. Sikorski, my point was not to engage in a debate over matters that are beyond my capacity fully to understand. I have great respect for Administrator Ruckelshaus' personal technical ability and that of the people with whom he's surrounded himself.

My point was simply that I think that almost everybody that I have recently asked the question of, when we get into acid rain, "Is there anything being done about this under present circumstances?" And most people would throw their hands and say, "No," being totally unaware that the Clean Air Act, enacted 1970 and amended many times since, does cause work to be done to mitigate that problem. And I just simply voiced that because it is one of those facts of life which, I think, has gotten overlooked as we have moved in this land to clean up an environment which, most certainly, needed cleaned up.

Mr. **Sikorski.** I think the point is well made.

The additional point, however: People shouldn't take any comfort in the fact that there is a national Clean Air Act in the context of acid rain, because it only addresses localized sources and emissions of the precursors of that acid rain. It doesn't address—because you know, working on that task force in the Governors' Association, the reason you're talking about it is the Clean Air Act doesn't address the interstate transportation of those precursors.

Mr. **Waxman.** Would the gentlemen yield?

Mr. **Sikorski.** I'm done. Thank you.

Mr. **Sharp.** One of the important questions the Governor's raised is how quickly we expect the new plants to come on line and, therefore, get the benefit that they'll have tighter clean air standards. I think one of the problems in this, which we should pursue with our utility witnesses as well as, I hope, your subcommittee will with others, as you've already begun, is, of course, the question that the economics have changed radically, as we're painfully aware in Indiana, in the electric utility industry. And so, a few years ago, when they would let the life of a plant, I believe, be roughly 30 years and that we're ready to phase it out and go to something new, that paid off for electric utility ratepayers to do it that way. The trouble is the expense of new powerplants, whether they're coal-fired or nuclear, are horrendous. And so, the more they can do to stretch out the use of old plants, usually now, unlike in the past, not always is to the benefit of the ratepayer.

Governor ORR. Oh, sure.

Mr. SHARP. But, of course, what that means is one of the things we need to look at is, if we're serious by the year 2000 in having a decline in SO_2 emissions, whether it's cheaper for the ratepayers of Indiana to build new plants, or whether it's cheaper for the ratepayers in Indiana to put scrubbers on the seven plants that this legislation calls for. I'll bet you it will be a lot cheaper to put the scrubbers on those seven plants than to phase them out. But I think that's something we'll need to know specifically about the plants that are involved here. And I hope that's the kind of data we can generate.

Governor ORR. Well, Congressman Sharp, I think it needs to be said that whatever method that will get the job done is appropriate.

The concern that the State of Indiana has, as well as those States that are Midwest coal producers, is that if this is a national problem, which it most certainly is, that the cost is borne on an equitable basis, rather than it be borne solely by the ratepayers in Indiana. I've seen quotations here in Indiana where you've made the same point.

Mr. SHARP. I couldn't agree with you more. And one of my objects in this hearing, in working with these two gentlemen, is to keep them open to us in Indiana. They, for the first time, have come up with a piece of legislation that spreads the cost far and wide. I'm delighted with that part of their bill. And I want to continue to work with them and hold open with them the possibility that Indiana can work with them on some of this, as long as we can spread that cost far and wide to diminish the impact on us. But I haven't yet endorsed this legislation, or any other.

Mr. WAXMAN. Governor, thank you very much. We appreciate your willingness to be with us, and we want to work with you, because we know this is a national problem; we need a national solution to it; and we need to all work together if we're going to accomplish that goal.

Thank you very much for being here.

Governor ORR. Let me conclude my comments, Mr. Chairman, by saying I genuinely appreciate your presence here. You're in the State of Indiana where many of the problems lie, and, also, maybe you've become that much more aware of how some of the solutions can be arrived at. I appreciate the opportunity to appear before you.

Mr. WAXMAN. We'd like now to call forward three witnesses who will testify together in a panel: Russell Stilwell, who is the coordinator of the United Mine Workers Coal Political Action Committee; Kathy Hubbard, executive director, Hoosiers for Economic Development; Jim Maguire, president, Indiana Coal Council.

I'd like to welcome you to our hearing today. Your prepared statements will be made part of the record in full. We'd like to ask you to summarize those statements in 5 minutes. And, Mr. Stilwell, we'd like to start with you.

STATEMENTS OF RUSSELL STILWELL, INTERNATIONAL COMPAC COORDINATOR, INDIANA, UNITED MINE WORKERS OF AMERICA; KATHRYN HUBBARD, EXECUTIVE DIRECTOR, HOOSIERS FOR ECONOMIC DEVELOPMENT, ACCOMPANIED BY DAVID LANTZ, RESEARCH ANALYST; AND JAMES F. MAGUIRE, PRESIDENT, INDIANA COAL COUNCIL, INC.

Mr. STILWELL. Thank you, Mr. Chairman.

Mr. Chairman and members of the Committee, my name is Russell Stilwell, and I'm a coal miner from southern Indiana. I spent 11 years working in the coal mines, from 1970 to 1981.

I'm presently employed as an employee of the United Mine Workers of America, District 11, which covers the entire State of Indiana.

I'm accompanied by Larry Reynolds, our district 11 president, here today.

On behalf of the United Mine Workers and, in particular, the mine workers in Indiana, we would like to thank this committee for holding this very important hearing here in Indianapolis. It is especially gratifying to have the opportunity to address this committee in our native Hoosier State, where over 30 million tons of coal are produced annually. Our minable reserves in this State are 17 billion tons.

On behalf of the 250,000 members of our organization nationwide, and approximately 6,000 in the State of Indiana who mine this coal, we applaud the concern that this committee and the chairman of this committee have shown for the jobs of coal miners and for the need to use technology to assure the clean burning of coal.

United Mine Workers agree that decisions made with regard to the National Clean Air Policy are vitally important. Air pollution control has been a major national priority for nearly 20 years. Improvements in air quality have involved substantial costs, but the United Mine Workers agree that the trend has been good for the public health and the environment.

However, we must recognize that some of the costs, particularly the disruption of coal mining jobs and communities, have been unnecessary. We must assure these workers and their families that they will not be forced to sacrifice their livelihood as we pursue the worthy goals of the Clean Air Act.

Secure employment always has been a priority for those of us who represent workers. Today, that concern looms even larger. Data from the Mine Safety and Health Administration indicate that there were about 60,000 fewer workers in the bituminous coal industry in the first half of 1983, as compared to the 1982 average. These numbers translate into an industry-wide unemployment figure of approximately 30 percent. Right here, in the State of Indiana, our rates are approximately 35 percent for unemployment for our membership.

Our fear is that this already gray situation in our coal mining communities could be further aggravated by acid rain control legislation.

Because of these dramatic economic consequences are clearly unacceptable, Mr. Chairman, you and Mr. Sikorski, along with other Representatives, have introduced H.R. 3400 that attempts to deal with acid rain, while avoiding wholesale job disruption. I believe this is the first emissions bill that really seeks to find some sort of mechanism to protect jobs as a coal miner, and, on behalf of my brothers and sisters in the coal fields, I want to, personally, thank the chairman and Mr. Sikorski for your sincere efforts in your attempts to protect our jobs. We really do appreciate that.

We fear, however, that H.R. 3400 also will lead to the loss of coal mining jobs, even though its expressed purpose is to protect jobs. These losses could occur in two ways: First, there's a likely potential of fuel switching as utilities attempt to meet the 3 million ton sulfur dioxide reduction contemplated in the bill.

Second, we believe that the age of the targeted top 50 plants will encourage the companies to retire some of the plants instead of retrofitting them with scrubbers.

With regard to the additional 3-million-ton reduction, we have examined potential job losses in the coal industry if fuel switching occurs for that 3-million-ton deduction. Our analysis shows that over 13,000 coal miners could lose their jobs in six coal producing states if 50 percent of the 3-million-ton reduction was achieved by fuel switching; the total number of jobs displaced, close to 45,000.

In addition to these potential job losses, we're concerned that the age of many of the powerplants that would be targeted for scrubbers, under H.R. 3400, would lead to utility companies to return them early rather than apply scrubber technology.

Take a case here in Indiana. Here, in Indiana, six plants are listed as targets for scrubber technology, which have SO_2 of more than three parts per million Btu's. These six plants represent 27 different units. The average of these 27 units, by the year 1990, the date for compliance of the act, would be 32.9 years of age. We believe that it's a realistic assumption these plants would shutdown rather than to be retrofitted. We can only look into the future to suppose what utilities might do, but we have a real concerned fear of that.

lieve that it's a realistic assumption these plants would shut down is just as devastating to coal miners as one that switches its fuel supply.

United Mine Workers believe that the magnitude of job lossed described is unacceptable, particularly, in the light of current lack of scientific consensus on the issue. That's why we strongly support legislation which has been introduced in both the House and the Senate to accelerate the ongoing studies and the causes and effects of acid rain. We must have more data on control legislation before it's enacted. We're not necessarily proposing that we postpone this indefinately, but we definately need the money available to find out what the correct data is; what is a basic consensus of the scientific community.

Acid rain is certainly a complex and decisive issue that cuts across many disciplines and many interests.

Scientists continue today to argue causes and cures; economists argue costs and the benefits; and many politicians argue equity and feasibility.

If society, as a whole, through its elected officials, determines to take action to control acid rain, then the action must be equitable. The United Mine Workers submit that there is no equity in solutions that result in the loss of thousands of jobs and the economic destruction of the communities in which we live.

In closing, I would like to, again, applaud the chairman and Mr. Sikorski for their attempts to deal with acid rain while considering coal miner unemployment. We certainly appreciated that here, in Indiana. When this bill was first introduced, many of the miners in Indiana looked at this as the piece of legislation that, perhaps, can really deal with the potential unemployment.

Although we don't agree on the specifics of H.R. 3400, we are, indeed, encouraged by the approach taken that acid rain should be considered a national problem and not just a regionalized issue.

We certainly appreciate the opportunity to share our comments.

[Testimony resumes on p. 529.]

[Mr. Stilwell's prepared statement and attachment follow:]

STATEMENT OF RUSSELL STILWELL

INTERNATIONAL COMPAC COORDINATOR, INDIANA

UNITED MINE WORKERS OF AMERICA

Mr. Chairman and Members of the Committee. My name is Russell Stilwell. I am a coal miner from Boonville, Indiana. I have spent over eleven years working in the coal mines in Southern Indiana from 1970 to 1981. I am presently employed as the International COMPAC (Coal Miner Political Action Committee) Coordinator for the UMWA District #11, which covers the State of Indiana.

On behalf of the UMWA we would like to thank the Committee for holding these very important hearings. We would further like to applaud the concern the Committee has shown for the jobs of coal miners and for the need to use technology to assure the clean burning of coal.

The United Mine Workers of America is composed of approximately one-quarter million working, retired and unemployed coal miners throughout the United States and Canada. While our membership is heaviest in the coal-mining communities east of the Mississippi River, we represent thousands of underground and surface coal miners in western states, including Arkansas, Oklahoma, Kansas, Missouri, Arizona, New Mexico, Colorado, Utah, Wyoming, Montana and North Dakota. All told, we represent approximately 70 percent of the workers in the U.S. coal industry.

Mr. Chairman, coal has provided the energy for America's social and industrial progress. Throughout the first half of the century coal and coal miners provided the backbone of

American industrial might. Coal provided heat and electricity to homes, businesses and factories and powered transcontinental railroads and transoceanic ships.

In the last thirty years, however, coal has been subordinated to petroleum and natural gas as an energy source, and substantial federal resources have been allocated to the development of nuclear power. The UMWA believes that the energy policies of the last thirty years have weakened our economy and threatened our national security. To regain energy independence and economic strength, the U.S. must adopt energy and economic policies that rest squarely on coal.

Formulating an energy policy with coal as its centerpiece requires a comprehensive review of the coal cycle from production to end use. The various elements cannot be viewed in isolation; major problems in transportation, production, consumption, or in regulatory or tax policy can impede the development and growth of the coal industry. Coherent policies can allow us to achieve our goal of energy security, help revitalize our industrial heartland and create jobs in all sectors of the economy.

That is why decisions made with regard to national clean air policy are vitally important. For nearly twenty years, control of air pollution has been a major national priority. Because of concerted national efforts, the quality of the air has improved markedly over the last decade. To be sure, improvements in air quality have involved substantial costs, but most observers agree that the trend has been good for both public health and the environment. However, we must recognize that some of the costs -- in particular the disruption of coal mining jobs and communities -- have been unnecessary. We must assure these workers and their families that they will not be forced to sacrifice their livelihood as we pursue the worthy goals of the Clean Air Act.

For these reasons, the Act should continue to serve as a tool to encourage and foster the development of new technologies to control air pollution. Technology-based pollution control strategies protect current jobs and provide new ones. One such strategy is embodied in the "percentage reduction" provision of the 1977 Clean Air Act Amendments, which requires all new power plants built in the United States to apply technology to reduce emissions. In this way, traditional coal markets and employment are protected. In addition, percentage reduction allows all of our coal resources throughout the nation to be burned in power plants while still meeting the national ambient air quality standards that protect public health. This provision is a good example of public policy that is both economically and environmentally beneficial. It allows us to use our vast coal resources while moving toward energy independence. The concept of "percentage reduction" will save thousands of jobs and will allow our nation's industrial base to continue to use relatively inexpensive local coal while moving toward cleaner air.

Secure employment always is a priority for those of us who represent workers. Today, however, that concern looms ever larger. Unemployment already has taken a severe toll on coal miners and coal field communities. Data from the Mine Safety and Health Administration indicate that there were about 60,000 fewer people working in the bituminous coal industry in the first half of 1983, as compared to the average 1982 employment. These staggering numbers translate to an industry-wide unemployment rate of about 30 percent. This already grave situation in the coal mining communities could be exacerbated by acid rain control legislation. The magnitude of job losses associated with acid rain controls is dependent on the utility industry's response to mandated reductions. The in- dustry has several options by which it can fulfill the require- ment of reducing sulfur dioxide emissions at existing generat- ing units. Utility companies could retrofit the units with scrubbers, retire older units and replace them with less pol- luting ones, wash or blend their coal supplies to decrease sul- fur content or switch from high-sulfur coal to lower-sulfur coal.

The degree of fuel switching that occurs as utilities attempt to reduce emissions will determine the extent of unemployment that will result from acid rain control legislation. Some proponents of acid rain legislation actually have touted fuel switching as a low-cost means of addressing the acid rain issue, but an examination of the job losses inherent in fuel switching clearly shows this solution to be an economic disaster.

The US Department of Energy has projected that between 50 and 75 percent of the emissions reductions would be achieved by fuel switching, if a bill similar to the 1982 Senate Environment and Public Works Committee bill became law. A UMWA analysis of acid rain employment impacts showed that if 50 percent of the reductions were achieved by fuel switching, over 39,000 high-sulfur coal miners would lose their jobs.

Under the 75 percent projection nearly 60,000 coal miners could face the unemployment line. Of course, these direct job losses would lead to indirect job losses in support and service industries.

Assuming a conservative 2.25 jobs multiplier, between 87,000 and 134,000 additional jobs could be lost due to the utilities' actions. Other analyses support these conclusions. As an example, the Congressional Research Service analyzed job losses in six states that are most affected by coal market shifts due to acid rain. These states include Illinois, Indiana, Kentucky, Ohio, Pennsylvania and West Virginia. CRS concluded that the direct coal mining job losses would range from 21,950 to 32,850 in those six states. With the addition of the indirect job losses that would occur, CRS concluded that between 71,338 and 106,762 people could lose their jobs in these areas. (see Attachment I).

The Energy Information Administration has published a report analyzing the market impact of acid rain controls. EIA made specific projections on coal tonnage that would be lost in four states, Illinois, Indiana, Pennsylvania and Ohio.

Using EIA's projections we calculated employment impacts based on 1982 average productivity in those states. The combined analysis showed the following: Illinois would lose 37 million tons of production by 1995, representing approximately 60 percent of total 1982 production. This would result in the loss of 11,932 coal industry jobs in Illinois. Using again the 2.25 indirect jobs multiplier, the total job loss in Illinois would be 38,779.

Indiana is projected by EIA to lose 14 million tons of coal representing about 47 percent of 1982 production. This would mean a direct job loss of 3,016 coal mining industry jobs, while the total job loss would be 9,802. Pennsylvania is estimated to lose 20 million tons representing 27 percent of

1982 production. Coal mining job losses would reach 7,874, and total job losses for Pennsylvania would be 25,590. EIA projected Ohio to lose 16 million tons or 44 percent of 1982 production. The coal mining industry in Ohio would lose 5,694 jobs while, overall, Ohio would lose 18,505 jobs.

Because these drastic economic consequences clearly are unacceptable, Mr. Chairman, you and Mr. Sikorski, along with other representatives, have introduced a bill that attempts to deal with acid rain while avoiding wholesale job disruption. I believe that this is the first emissions reduction bill that has been introduced that seeks to protect jobs. As a coal miner, I want to thank the Chairman for his sincere efforts in that regard.

We fear, however, that H.R. 3400 also will lead to the loss of coal mining jobs even though its expressed purpose is to prevent this occurance. These job losses could occur in two ways: First, there is a potential, perhaps even a likelihood, that a significant amount of fuel switching will occur as utilities attempt to meet the three million ton residual sulfur dioxide reduction contemplated in the bill. Second, we believe that the age of some of the targetted "top fifty" utility plants will encourage the companies to retire some of the units instead of retrofitting them with scrubbers.

With regard to the additional three million ton reduction requirement, we have examined potential job losses in the coal industry if fuel switching occurs. Our analysis shows that over 13,600 coal miners could lose their jobs in six coal producing states if 50 percent of the three million ton reduction was achieved by fuel switching. For purposes of comparison, we reviewed tonnage disruption estimates for the same areas that were calculated by OTA and Peabody Coal Company. Applying the same methodology to these estimates, we calculated coal miner job displacement. OTA's tonnage displacement results in slightly more than 9,700 losing their jobs while Peabody's estimate for those six states shows nearly 15,300 coal miners would lose their jobs. The total number of jobs displaced, of cource, would be much higher. The combined direct and indirect job displacement is shown in Attachment II.

In addition to these potential job losses, we are concerned that the age of many of the power plants that would be targetted for scrubbers under H.R. 3400 will lead the utility companies to retire them early rather than apply scrubber technology. A review of specific utility in-service dates shows that nearly half of the units would be thirty years old by 1990, the date for compliance. In terms of unemployment, a plant that is shut down is just as devastating to coal miners as one that switches its fuel supply.

The UMWA believes that the magnitude of job losses described herein is unacceptable, particularly in light of the current lack of scientific concensus on the issue. That is why the UMWA strongly supports legislation, which has been introduced in both the U.S. House of Representatives and the Senate, to accelerate the ongoing study of the causes and effects of acid rain. We must have more data before control legislation is enacted. Legislation that would disrupt the economies of major coal producing regions, lead to unnecessary increases in oil and gas use, seriously hamper the coal export trade, and lead to increased unemployment among coal miners simply cannot be justified at present.

However, this does not mean that we cannot begin immediately to treat those lakes found to contain high levels of acidity. According to the Environmental Protection Agency, studies have shown that treating the affected lakes with limestone or soda ash can have very beneficial effects on plants and fish life in the affected areas. The cost of such a program has been estimated to be $19 million if all the known acidified and threatened bodies of water were treated. The UMWA sincerely believes that the issue of acid rain must be met head on, but it must be done on the basis of solid scientific evidence.

Acid rain is a complex and too often divisive issue that cuts across many disciplines and interests. Scientists continue to argue causes and cures. Economists argue costs and benefits. Politicians argue equity and feasibility. Questions about the nature of this phenomenon will continue for many years. Despite the questions, however, there is considerable political pressure to do something. If society as a whole, through its elected officials, determines to take action to control acid rain, then the action must be equitable. The UMWA submits that there is no equity in solutions that result in the loss of thousands of jobs and the economic destruction of hundreds of communities.

ATTACHMENT I

COMPARATIVE ANALYSIS OF THE IMPACT OF S.768 IN SIX SELECTED STATES [1]

	ICF, INC. [2]	PEABODY COAL [2]	UMWA [3]
Coal Displaced (mm tons)	87.7	111.2	102.0
Coal Mining Jobs Displaced	21,950	32,850	34,838
Total Jobs Displaced [4]	71,338	106,762	113,223

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[1] Pennsylvania, Ohio, West Virginia, Illinois, Indiana and Kentucky.

[2] Figures derived from "Mitigating Acid Rain: Implications for High Sulfur Coal Regions", Congressional Research Service, May 16, 1983.

[3] "Employment Impacts of Acid Rain", United Mine Workers of America, April, 1983.

[4] Assumes a jobs multiplier of 2.25.

ATTACHMENT II

COMPARATIVE ANALYSIS OF THE IMPACT OF H.R. 3400 IN SIX SELECTED STATES [1]

	OTA [2]	PEABODY COAL [3]	UMWA [4]
Coal Displaced (mm tons)	26.1	41.2	38.3
Coal Mining Jobs Displaced [5]	9703	15,287	13,629
Total Jobs Displaced [6]	31,535	49,683	44,294

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[1] Pennsylvania, Ohio, West Virginia, Illinois, Indiana and Kentucky.

[2] "An Analysis of the Sikorski/Waxman Acid Rain Control Proposal". Staff Memorandum, Office of Technology Assessment, June 21, 1983. The OTA analysis calculated coal production displacement on a regional basis only; for purposes of comparison, Appalachia is assumed to encompass Pennsylvania, Ohio and West Virginia while the Central region is assumed to encompass Indiana, Illinois and western Kentucky.

[3] "Economic Impacts of Acid Rain Control", Peabody Coal Company, presented to the Coalition of Northeast Governors, August 23, 1983.

[4] Derived from "Employment Impacts of Acid Rain, United Mine Workers of America, April 1983.

[5] Calculations based on 1982 annual productivity of 2526.4 tons per worker in Appalachia and 3203.2 tons per worker in the Interior Basin. Derived from Mine Injuries and Worktime, Quarterly, Closeout Edition 1982, Mine Safety and Health Administration, U. S. Department of Labor.

[6] Assumes a jobs multiplier of 2.25.

UNCONSIDERED EFFECTS OF
THE I/M POWER PLANT
INDIANA / MICHIGAN ELECTRIC
ROCKPORT, INDIANA
ON THE INDIANA ECONOMY

Indiana and Michigan Electric Company, a subsidiary of American Electric Power, is installing a massive powerplant in southern Indiana. The plant will consist of two 1300 megawatt units that will provide power to customers in eastern and northern Indiana and southern Michigan. The first unit is scheduled to come on line in 1984 and the second in late 1986.

The new powerplant, located in Rockport, Indiana, could prove to be a boost to the Indiana economy--if the units would use locally available Indiana coal. I/M officials have stated publically, however, that no coal mined in Indiana will be used in the Rockport facility.

According to the utility company, the two units will consume 7-11 million tons of coal per year when fully operational. Low sulfur coal, to be burned without scrubbers, will be imported to Indiana from eastern Kentucky and from the West. The western states likely to supply fuel to the new powerplant are Wyoming and Utah.

Federal law requires that all powerplants built after September 1979 meet an emissions limit of 1.2 pounds of sulfur dioxide per million Btu of heat input plus achieve a "percentage reduction" in emissions through the use of best available control technology. In other words, all new powerplants must install scrubbers--except Indiana and Michigan's Rockport facility. The new I/M plant will be the last coal-fired units built in the United States that will not be required to utilize scrubber technology. Without the use of scrubbers, Indiana coal miners and coal companies will receive no benefit from the new plant because of the higher sulfur content of Indiana coal. (Indiana coal will have to be scrubbed to be used in the Rockport units.)

The decision to use coal from other states without scrubbers, will cost Indiana thousands of potential jobs and will result in billions of dollars in lost wages and millions of dollars in foregone tax revenue over the life of the plant. Equally important, consumers in Indiana and Michigan will face higher electricity bills because of the greater cost of coal from eastern Kentucky and the West.

I/M could use Indiana coal and stimulate the state's economy simply by installing flue gas desulfurization equipment on the two units. The capital cost for scrubbers on the Rockport plant would be $171,990,000 per unit, or approximately $344 million for the entire facility. The annual cost for operation and maintenance of the two scrubbers would be approximately $145.4 million[1]. It might appear that I/M will save millions of dollars for its electricity customers by not installing scrubbers at the Rockport facility. However, this is not the case.

To be sure, scrubber equipment is expensive to build and maintain; but to estimate the cost to consumers, it is necessary to consider the cost of fuel over the life of the plant. Table II shows the actual 1980 delivered prices for coal from various states. Although Indiana coal is not being considered by the utility, it is included for purposes of comparison. As is seen in the table, Indiana coal holds a substantial cost advantage in dollars per ton and in cost per million Btu. In other words, consumers will pay three times more for Utah coal than locally available coal and nearly twice as much for coal from Wyoming and Kentucky.

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[1] EPA Utility Flue Gas Desulfurization Survey: April - June 1981, U.S. EPA, Office of Environmental Engineering and Technology, August 1981. See Table I.

TABLE I

Scrubber Costs for Rockport's 1300 Megawatt Units[2/]

Capital Costs - FGD Retrofit

Range $/kw	$57.5 - $258.9
Adjusted Average $/kw	$132.3
Range $-Rockport	$74,750,000 - $336,570,000
Average $-Rockport	$171,990,000
Total - 2 units	$343,980,000

Operation and Maintenance Costs - 70 percent capacity

Range Mills/kwh	4.2 - 18.67
Adjusted Average Mills/kwh	9.12
Range $/yr	$33,480,720 - $148,829,772
Average $/yr	$72,700,992
Total $/yr - 2 units	$145,401,984

[2/] EPA Utility Flue Gas Desulfurization Survey: April - June 1981, U.S. EPA, Office of Environmental Engineering and Technology, August, 1981.

TABLE II

Delivered Coal Costs in Indiana[3/]

Indiana Coal

Average sulfur content	2.78%
Btu/ton	21,688,000
$/ton	$23.07
¢/million Btu	106.4

Utah Coal

Average sulfur content	.56%
Btu/ton	24,238,000
$/ton	$73.82
¢/million Btu	304.5

Wyoming Coal

Average sulfur content	.65%
Btu/ton	21,338,000
$/ton	$42.91
¢/million Btu	201.1

Eastern Kentucky Coal[4/]

Average sulfur content	.81%
Btu/ton	25,340,000
$/ton	$56.44
¢/million Btu	222.7

[3/] *Cost and Quality of Fuel for Electricity Utility Plants, 1980 Annual*, U.S. Department of Energy, Energy Information Administration, June 25, 1981.

[4/] In 1980, no Kentucky coal of sufficient quality to be burned without scrubbers (in new powerplants) was used in Indiana. Figures cited are eastern Kentucky "compliance coal" used in Illinois; the cost data, therefore, are somewhat overstated. The national averages for eastern Kentucky coal are:

Sulfur	1.1%
Btu/ton	24,386,000
$/ton	$39.84
¢/million Btu	163.4

The actual delivered cost for Kentucky "compliance coal" in Indiana likely will fall between the national average and the delivered cost in Illinois.

Even when the cost of scrubbing is included in fuel cost projections, Indiana coal remains economically attractive. Table III shows the life cycle fuel costs for coal from the various states. As stated previously, Indiana coal must be scrubbed while the low sulfur coal will not be scrubbed. The figures clearly indicate that Indiana coal is economically competitive despite the initial cost of the scrubbers. Using the 11 million tons per year maximum estimated by I/M, electricity customers would save $2-12 billion in fuel costs over the life of the plant by using locally available coal. At 9 million tons per year, the customers would save as much as $9 billion.

Why would the utility company wish to pay a premium price for coal transported from long distances? Why would they subject their customers to billions of dollars in unnecessary fuel costs instead of applying available and proven technology to reduce costs in the long run? The answer lies mainly with the method of cost recovery. Scrubbers are considered capital expenditures and must be calculated in the rate base. The utility, therefore, recovers the cost of the equipment over the life of the plant. Increased fuel costs, on the other hand, can be passed along to the consumer through the Fuel Adjustment Clause. The utility immediately recovers the higher fuel and transportation charges--and the customer suffers.

TABLE III

Life Cycle Fuel Costs[5]

A. Variable tonnage, Btu weighted[6]

Indiana[7]	$ 9,392,559,550
Wyoming	8,848,901,880
Utah	13,401,759,000
Kentucky[8]	9,800,877,719

B. 7 million tons per year

Indiana[7]	$ 9,550,739,520
Wyoming	9,011,100,000
Utah	15,502,200,000
Kentucky[8]	11,852,400,000

C. 9 million tons per year

Indiana[7]	$10,934,939,000
Wyoming	11,585,700,000
Utah	19,931,400,000
Kentucky[8]	15,238,800,000

D. 11 million tons per year

Indiana[7]	$12,319,139,000 +
Wyoming	14,160,300,000
Utah	24,360,600,000 +
Kentucky[8]	18,625,200,000

5/ Estimates assume 30 year life for two 1300 mw units. Figures reflect 1980 dollars.

6/ Tonnage required is calculated on the basis of two 1300 mw units operating at 70 percent capacity with a 37 percent (9200 Btu/kwh) efficiency rate. Estimates assume 146.7 trillion Btu/yr required. Cost figures derived from the following tonnage assumptions:

Indiana	6,763,069 tons/yr
Wyoming	6,874,001 tons/yr
Utah	6,051,549 tons/yr
Kentucky	5,788,375 tons/yr

7/ Indiana costs include capital expenses for two scrubbers, yearly operations and maintenance costs, as well as fuel costs.

8/ Using the average delivered price nationwide for compliance coal from eastern Kentucky the life time fuel costs for I/M would be:

In Indiana, the cost of transportation can be included in the fuel adjustment charge after a public hearing. To date, the hearings have provided almost automatic approval for the utilities to include high transportation costs in the fuel adjustment. I/M customers, therefore, will pay hundreds of millions of dollars a year in exorbitant and unnecessary charges--simply because I/M refuses to install proven and available scrubber technology. Table IV shows the amount of money that Indiana and Michigan electricity consumers will pay in severance taxes that will flow into the state coffers of Kentucky and Wyoming. Instead of stimulating the economy of Indiana, portions of the monthly electricity bill will go directly to other states. Over the life of the plant, Indiana and Michigan consumers could contribute $792 million to Wyoming or $541.2 million to Kentucky in severance taxes alone.

The potential economic impact of the I/M Rockport plant in Indiana is great. The impact will be negligible, however, if the utility does not use Indiana coal. Tables V and VI summarize the employment and economic effects of using Indiana coal at the Rockport units. Depending on the amount of coal consumed, between 1430 and 2407 new coal mining industry jobs would be created in Indiana. Those coal mining jobs would generate an additional 3304 to 6186 indirect jobs. The total employment impact of using Indiana coal at Rockport, therefore, would be 5284 to 8593 jobs. The economic impact of those jobs, as shown in Table VI, would be tremendous. Total income in wages would range from $91.6 million to $149 million per year, depending on the amount of coal consumed. Over the life of the Rockport plant, that would generate between $2.7 billion and $4.5 billion in direct income for the workers of Indiana.

The state revenue that would be derived from those jobs also is substantial. The total income tax revenue generated per year would be $1.6 million to $2.7 million. The sales tax that the wage earners would contribute would range from $1 million to $1.7 million each year. Over the life of the new I/M plant, between $80.9 million and $131.5 million would be added to Indiana's tax revenue--if the utility would use Indiana coal.

TABLE IV

Severance Taxes[9]

A. Variable tonnage, Btu weighted[10]

Wyoming[11]	$16,497,602
Kentucky[12]	9,494,935

B. 7 million tons per year

Wyoming[11]	$16,800,000
Kentucky[12]	11,480,000

C. 9 million tons per year

Wyoming[11]	$21,600,000
Kentucky[12]	14,760,000

D. 11 million tons per year

Wyoming[11]	$26,400,000
Kentucky[12]	18,040,000

9/ Severance taxes in Wyoming are based on 17 percent of the mine price; in Kentucky, tax is 4.5 percent of the mine price or 50 cents/ton, whichever is greater.

10/ Tonnage required is calculated on the basis of two 1300 mw units operating at 70 percent capacity with a 37 percent (9200 Btu/kwh) efficiency rate. Estimates assume 146.7 trillion Btu/yr required. Tax revenue derived from the following tonnage assumptions:

Wyoming	6,874,001 tons/yr
Kentucky	5,788,375 tons/yr

11/ Revenue estimates assume a price of $14.10/ton, FOB Mine.

12/ Revenue estimates assume a price of $36.36/ton, FOB Mine.

TABLE V

Employment Losses in Indiana

	A[13]	B[14]	C[15]	D[16]
Mining industry job losses[17]	1480	1532	1969	2407
Indirect job losses[18]	3804	3937	5060	6186
Total job losses	5284	5469	7029	8593

[13] Assumes annual tonnage requirements of:

Indiana	6,763,069 tons/yr
Wyoming	6,874,001 tons/yr
Utah	6,051,549 tons/yr
Kentucky	5,788,375 tons/yr

[14] Assumes 7 million tons/yr

[15] Assumes 9 million tons/yr

[16] Assumes 11 million tons/yr

[17] Mining industry job losses calculated by dividing output per coal mining industry employee in Indiana (4570 tons/yr). Figures derived from the U.S. Department of Labor, Mine Safety and Health Administration (MSHA), Injury Experience in Coal Mining, 1980. Because all coal mining industry employees are included in this figure, it differs from more traditional "miner productivity" statistics.

[18] Indirect job losses are calculated by multiplying direct mining job losses by 2.57, the regional indirect jobs multiplier. The jobs multiplier reflects the average relationship in Indiana coal producing counties between basic sector employment and non-basic sector employment. (See Footnote 20).

TABLE VI

	A	B	C	D
INCOME LOSSES				
ect Wage Losses/year[19]	$38,181,128.80	$39,522,627.92	$ 50,796,380.14	$ 62,095,930.42
irect Wage Losses/year[20]	54,453,580.32	55,331,679.09	71,114,932.20	86,934,302.59
al Wage Losses/year	91,634,709.12	94,854,307.01	121,911,312.30	149,030,233.01
al Wage Losses/ Year Plant Life	$2,749,041,274	$2,845,629,210	$3,657,339,369	$4,470,906,990
STATE REVENUE LOSSES				
ome Tax Losses/year[21]	$ 1,636,668	$ 1,694,011	$ 2,177,219	$ 2,661,639
es Tax Losses/year[22]	1,060,004	1,097,129	1,410,079	1,723,823
al Tax Losses/year	2,696,672	2,791,140	3,587,298	4,385,462
al Tax Losses/ Year Plant Life	$80,900,160	$83,734,200	$107,618,940	$131,563,860
AL ECONOMIC LOSSES	$2,829,941,434	$2,929,363,410	$3,764,958,309	$4,602,470,850

Direct wage losses are derived by multiplying the direct mining job losses by the average annual earnings for coal mining industry employees, weighted between production and office workers ($25,798.06).

Indirect wage losses are derived by multiplying the direct wage losses by 1.4--the indirect economic losses multiplier computed for the coal mining regions in Indiana. The multiplier reflects the average relationship between basic and non-basic income. Mining, agriculture, and manufacturing comprise the basic sector; total community earnings less basic sector income constitute the non-basic sector. Income and earnings taken from Local Area Personal Income, 1974-1979, Volume 4 (Great Lakes), Bureau of Economic Analysis, U.S. Department of Commerce, June 1982.

Income tax computed on the basis of $471/yr for a married taxpayer with two children who earns $25,798.06/yr (miner) and $247/yr for a married taxpayer with two children who earns $14,052/yr (indirect jobs).

Sales tax computed on the basis of IRS allowable deductions for sales tax in Indiana [$251/yr for $24,000-26,000 wage earners(miners), $181/yr for $14,000-16,000 wage earners (indirect jobs)].

CONCLUSION

All of the foregoing shows that the customers of I/M, the workers and the state of Indiana would benefit if the I/M Rockport facility would burn Indiana coal. Why is I/M going out of state for their coal? Apparently, I/M will go out of state to preserve higher profits for their investors while insuring higher utility bills for their customers. Is the sulfur content too high to be cleaned effectively with scrubbers? NO! Present day technology exists to install scrubbers on powerplants that remove impurities to meet the most rigid EPA regulations. All new powerplants must meet this scrubber requirement today. The Rockport plant should do so as well.

Can Indiana really produce an additional 7-11 million tons per year by 1984? YES!

Indiana has coal resources of nearly 18 billion tons. This is enough energy to run the entire country for well over 20 years. Currently, there are several mines working less than a full week and approximately 800 miners on permanent lay-off status. New coal markets are needed for the Indiana coal fields. Industry and labor have expertise, capital and know-how to extract any amount of coal from Indiana soil if there are customers.

The Indiana/Michigan Electric powerplant in Rockport, Indiana could have a long-lasting, positive impact on the Indiana economy! Indiana/Michigan Electric could generate hundreds of millions of dollars to wage earners. I/M could provide Indiana with much needed tax resources! I/M could provide a useful utility service stimulating the local and regional economies in which it is located. I/M could be a long-lasting partner in the social and economic lives of Hoosiers. AND, Indiana/Michigan could do all this in a more cost effective way. All they need to do is.......

BURN INDIANA COAL!!!!!!!!!

Mr. **Waxman**. Thank you very much for that excellent testimony. Ms. Hubbard, we'd like to call on you next.

STATEMENT OF KATHY HUBBARD

Ms. **Hubbard**. Thank you, Mr. Chairman, and members of the committee. I'm very pleased to be here today.

The Hoosiers for Economic Development committee is a statewide educational organization composed of 15,000 members from a broad range of occupations and backgrounds. We have a common concern for Indiana's future and for economic development and job opportunities in the State. Our goal is to expand public understanding of issues that affect our economic future.

The two key areas in which we have devoted significant time and effort are the cost and availability of energy in Indiana, and the quality and improvement of the State's educational system. One of the major factors that could affect the cost of electric power to individuals and businesses is the passage of some acid rain control legislation.

The potential of major increases in energy costs and the potentially severe impact to Indiana's coal industry prompted us to explore and research the acid rain issue in greater depth.

Because of the economic impact in Indiana of some legislation and because our analysis revealed too little reliable scientific data exists on the complete causes and effects of acid rain, we do not support H.R. 3400. When we began our initial analysis and research of acid rain, in the summer of 1983, we examined many studies and reports from various scientific and governmental organizations. The National Academy of Science's study, though much hailed by many environmentalists as conclusive evidence that the Midwest is the primary source of the Northeast's acid rain problem, provides important evidence which is often overlooked. Some of these findings, which I will briefly review, bear significantly on the issue. One: There is no guarantee that Midwest emission reductions will reduce acid deposition in the northeastern United States. Two: Atmospheric models are inadequate in predicting the transport and consequences of emissions between localities. Three: The further a source is from a given receptor site, the smaller its influence on that site. In the summer of 1983, the Hoosiers for Economic Development Committee commissioned the Hudson Institute, a public policy research firm headquartered in New York, to perform an independent study of acid rain. Some of their findings worth repeating here today are as follows:

One, it is not known how much of the SO_2 and NO_x emissions are connected to acids—perhaps half, but this is still a guess, not scientific fact.

Two, it is not known how much acid deposition in any particular area comes from sources which are local, how much from nearby emissions, and how much comes from distant sources.

Three, too little is known about the natural causes of acidity.

The findings and conclusions from these and many other studies point to a tremendous lack of scientific data and much uncertainty as to the complete causes and effects of acid rain. The only certainty is the severe impact some acid rain control legislation would have on Indiana's economy and the economy of other States.

As we understand it, H.R. 3400 would require a reduction of 10 million tons of SO_2 by 1993, and mandate the use of scrubbers by 50 of the Nation's largest emitters, none of which are located in the 8 States surrounding the sensitive areas: Connecticut, Maine, Massachusetts, Rhode Island, Vermont, New Jersey, New Hampshire, and New York.

Furthermore, the 10 million ton reduction, as specified by the bill, would not guarantee measurable or significant reductions in acidity in the Northeast.

The tax or fee of 1 mill per kilowatt hour on all non-nuclear electricity consumption would subsidize less than 90 percent of the capital costs of the scrubbers. The bill does not fund operating and maintenance costs of scrubbers, or the costs for replacing power necessitated by retrofitting existing plants.

The bill does not totally prevent fuel switching. In fact, an additional 3.4 million ton reduction is required outside the reductions achieved by the 50 largest emitters. These other reductions could be achieved by fuel switching which could result in a loss of coal mining jobs in Indiana. The bill will, according to analysis by the research firm of Temple, Barker and Sloane of Lexington, Mass., cost a total of $109 million in constant 1985 dollars. They estimate, at least, a 21-percent increase statewide in electricity bills in Indiana.

In summary, the Hoosiers for Economic Development Committee supports an acid rain policy which includes four recommendations, and a resolution passed by the Indiana House of Representatives this week included all of these points; they are as follows:

One: Fund additional research to achieve a solid scientific understanding of the formation of acid rain, the relationship between Midwestern sulfur dioxide emitting industries, and the long distance travel of those emissions to other parts of the country, specifically the northeastern United States.

Two: Begin emission reductions targeted at local sources.

Three: In the interim, because of the lower cost and proven results, lake liming represents an effective short-term solution.

Four: Mandate national participation in any clean up costs.

Thank you very much for your time and for this opportunity to make our views known.

Mr. WAXMAN. Thank you very much for your testimony.

Mr. Maguire.

STATEMENT OF JAMES F. MAGUIRE

Mr. MAGUIRE. Mr. Chairman, members of the subcommittee, my name is Jim Maguire, and I am president of the Indiana Coal Council; a trade association representing Indiana's coal industry.

I appreciate the opportunity to express our views to this subcommittee. We commend your recognition that acid rain is a national problem that requires national solutions; however, we cannot lend our support to your legislation.

Our lack of support for H.R. 3400 stems from two major weaknesses in the foundation of the proposed law.

First of all, insufficient scientific knowledge of acid rain and, two, the failure to adequately address the impact of the bill on coal production and employment.

A diverse array of scientists have spoken on the acid rain issue, leading to the conclusion that the legislative proposals for emissions reduction are not supported by the present level of scientific understanding. I do not intend to completely review the level of scientific knowledge; however, I wish to discuss some key findings.

Researchers at MIT warn that policies calling for power plant emission reductions to solve acid rain will cost billions of dollars and may do little good. They point out that while the hasty adoption of regional uniform policies on acid rain may be politically expedient, further research may make possible policies that are more environmentally sound and cost effective.

The June 1983 National Academy of Sciences report on acid rain indicated that it was not possible to predict the impact of sulfur emission reductions in specific geographic locations on distant sensitive regions, and that a high priority be given to further study the problem. They emphasized the importance of local sources by stating that, as a rule of thumb, the further the source is from a given receptor site, the smaller its influence on that site will be per unit mass emitted.

In my oral remarks, I will not comment in detail on the impact of acid rain on forest productivity and crops; however, the scientific community is continuing to determine what, if any, adverse effects acid deposition has on agricultural and forest productivity.

Additionally, we believe that it has been adequately demonstrated that acid rain is not a health problem. We believe that the scientific uncertainty is adequately being addressed by current research efforts. The dollars committed by the U.S. Government through the national acid precipitation assessment program over the last 5 fiscal years are substantial, and we believe that the continued expenditure of funds in this program will, in a reasonable amount of time, reveal the facts necessary to develop prudent control strategies. Additionally, we strongly support the development of new technology which will allow a more effective implementation of these control strategies.

I would like now to address what we believe are the shortcomings of H.R. 3400.

First, the allocation formula in H.R. 3400 distributes the emission reduction disproportionately on a geographic basis. This formula does not reflect the spatial relationship of emission sources and the areas known to be sensitive to acid deposition.

Second, by arbitrarily selecting the 50 largest emitting powerplants, the bill further distorts any logical correlation between gross emissions and sensitive receptor area impacts. Also, because the formula exempts or requires only minimal emission reductions from 21 of the 38 States, including States in the most sensitive regions, significant economic and social burdens will be concentrated in those areas of the country still suffering from economic recession.

There is a compounded impact especially hitting our Indiana citizens.

First of all, Indiana rate payers will pay the costs in establishing the emissions control equipment trust fund.

Second, the expenses for operation and maintenance of the control equipment will need to be separately recouped, again, from Indiana rate payers.

Finally, the unemployment impact and increased industrial costs will also have an adverse impact on the State of Indiana.

By 1995, Indiana coal production will grow from its 1980 level of 30 million tons to 47 million tons. Under H.R. 3400, production growth will actually decrease by 7 million tons; a 16-percent decrease.

Additionally, this analysis assumes all of the Indiana electric utilities required to retrofit scrubbers will do so. In fact, however, many of the plants, because of age and physical constraints, will simply be prematurely retired.

A study done for Edison Electric Institute estimates that 6 million tons of Indiana coal consumption could be lost due to the premature retirement by these plants. Additionally, this analysis also assumes that there will not be a further increase in the use of western coal by Indiana utilities. In fact, 4.5 million tons of western coal were used by Indiana electric utilities in 1980. There is nothing to indicate that that growth of western coal being used by Indiana utilities will not continue. Thus, there is strong evidence under H.R. 3400 there may actually be a decline in Indiana coal production.

Mr. Chairman, I appreciate the opportunity of appearing before you and your subcommittee today. While I am not an expert, I will try to answer any questions which you have. Thank you.

[Testimony resumes on p. 550.]

[Mr. Maguire's written statement follows:]

James F Maguire, President
OFFICE (317) 638-6997

INDIANA COAL COUNCIL, INC.
701 HARRISON BLDG • 143 W MARKET STREET
INDIANAPOLIS INDIANA 46204

WRITTEN
STATEMENT OF
JAMES F. MAGUIRE
PRESIDENT
INDIANA COAL COUNCIL, INC.
BEFORE THE
SUBCOMMITTEE ON HEALTH AND THE
ENVIRONMENT
U.S. HOUSE OF REPRESENTATIVES
INDIANAPOLIS, INDIANA
FEBRUARY 10, 1984

MR. CHAIRMAN, MEMBERS OF THE SUBCOMMITTEE:

MY NAME IS JIM MAGUIRE. I AM PRESIDENT OF THE INDIANA COAL COUNCIL, A TRADE ASSOCIATION REPRESENTING INDIANA'S COAL INDUSTRY.

INTRODUCTION

THE GENERAL TOPIC OF DISCUSSION TODAY IS ACID RAIN, ITS CONTROL AND THE LEGISLATIVE PROPOSAL CONTAINED IN H.R. 3400, THE "NATIONAL ACID DEPOSITION CONTROL ACT OF 1983."

WE RECOGNIZE AND ACKNOWLEDGE THE IMPORTANCE OF THE ISSUE. OUR CANADIAN FRIENDS HAVE THIS PROBLEM AT THE TOP OF THEIR POLITICAL AGENDA. THEIR GOVERNMENT LOBBYING EFFORTS IN CONGRESS AND IN STATE REGULATORY PROCEEDINGS IS UNPRECE-

DENTED. THE STATES OF NORTHEASTERN AMERICA ALSO FEEL VERY STRONGLY ABOUT ACID RAIN CONTROL MEASURES. THE ADIRONDACK REGION OF NEW YORK IS ESPECIALLY VULNERABLE TO ACID DEPOSITION.

THE STATE OF INDIANA AND OUR COAL-FIRED ELECTRIC UTILITY GENERATING PLANTS HAVE BEEN IDENTIFIED BY SOME AS ONE OF THE STATES RESPONSIBLE FOR THE ACID DEPOSITION IN CANADA AND NORTHEASTERN UNITED STATES. LEGISLATION HAS BEEN INTRODUCED IN CONGRESS TO MANDATE REDUCTIONS IN SULFUR DIOXIDES AND NITROGEN OXIDES BELOW THOSE REDUCTIONS WHICH ARE REQUIRED BY THE CLEAN AIR ACT.

LEGISLATION LIKE THAT SPONSORED BY SENATORS MITCHELL AND STAFFORD PROPOSE TO PLACE THE BURDEN OF PAYING FOR THE EMISSION REDUCTIONS ON THOSE STATES REQUIRED TO REDUCE EMISSIONS. THE GOAL OF H.R. 3400 IS TO BRING ABOUT AN EMISSIONS REDUCTION THROUGH A NATIONAL PAYMENT PROGRAM. THE SIKORSKI/WAXMAN BILL ALSO ATTEMPTS TO MINIMIZE THE SOCIAL AND ECONOMIC COSTS TO THE HIGH SULFUR COAL PRODUCING STATES, LIKE INDIANA, THROUGH A MANDATORY SCRUBBER PROVISION.

WE APPRECIATE THE OPPORTUNITY OF BEING ABLE TO EXPRESS OUR VIEWS TO THIS SUBCOMMITTEE AND THE TWO INDIVIDUALS WHO ARE CO-SPONSORING H.R. 3400.

OUR POSITION ON H.R. 3400

WHILE YOUR PROPOSED LEGISLATION HAS MERIT, WE CANNOT LEND OUR SUPPORT. OUR LACK OF SUPPORT STEMS FROM TWO MAJOR WEAKNESSES IN THE FOUNDATION OF YOUR PROPOSED LAW: (I) INSUFFICIENT KNOWLEDGE OF ACID RAIN, AND (2) THE FAILURE TO ADEQUATELY ADDRESS THE IMPACT OF THE BILL ON COAL PRODUCTION AND EMPLOYMENT.

SOME SAY THAT WE KNOW ENOUGH TO ACT. THEY CONTEND THAT THE LONGER WE WAIT TO ACT THE WORSE OUR PROBLEM BECOMES. IF WE DON'T ACT NOW, LAKES, FORESTS, BUILDINGS AND HUMANS WILL BE IRREVERSIBLY HARMED.

OTHERS CONTEND THAT TIME IS ON OUR SIDE IF THE PROPER CORRECTIVE MEASURES ARE TAKEN PRUDENTLY. THEY SAY THAT ACTION NOW COULD RESULT IN AN EXTRAVAGANT EXPENDITURE OF EFFORT AND ENERGY FOR LITTLE OR NO BENEFIT. IF WE ACT NOW, PEOPLE, INDUSTRIES AND THE ECONOMY WILL BE NEEDLESSLY DISRUPTED.

THERE IS YET ANOTHER IDENTIFIABLE GROUP WHICH SAYS ACT NOW EVEN IF WE'RE WRONG ABOUT ACID RAIN. EVEN IF WE DON'T SOLVE THE ACID RAIN PROBLEM AT LEAST THERE WILL BE REDUCTION IN OVER-ALL SULFUR DIOXIDE AND NITROGEN OXIDES. WE WILL HAVE CLEANER AIR.

THE INDIANA COAL COUNCIL BELONGS TO THE SCHOOL OF THOUGHT THAT THINKS OUR NATION HAS MORE TO LOSE BY ACTING IMPRUDENTLY. THE SCIENTIFIC COMMUNITY IS ON THE THRESHOLD OF IMPORTANT FINDINGS WHICH WILL DIRECT OUR EFFORTS TOWARDS RESOLVING THIS PROBLEM. WE BELIEVE ANY LEGISLATION, EVEN WELL--INTENTIONED AND POLITICALLY ACCEPTABLE, SHOULD NOT BE ENACTED UNTIL THERE EXISTS A SOLID SCIENTIFIC FOUNDATION FOR SUPPORT.

THE WEAKNESSES IN THE SCIENTIFIC FOUNDATION

A DIVERSE AND CREDIBLE ARRAY OF SCIENTISTS HAVE SPOKEN ON THE ACID RAIN ISSUE, LEADING TO THE CONCLUSION THAT THE LEGISLATIVE PROPOSALS FOR EMISSIONS REDUCTION HAVE A WEAK SCIENTIFIC BASE.

M.I.T. STUDIES

THE ENERGY LABORATORY AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY WARN THAT POLICIES CALLING FOR POWER PLANT EMISSIONS REDUCTION TO SOLVE ACID RAIN WILL COST BILLIONS OF DOLLARS AND MAY DO LITTLE GOOD. TO "SAVE" THE ADIRONDACK LAKES AND OTHER SENSITIVE SPOTS, THEY NOTE THAT WE HAVE TO FIGURE OUT PRECISELY WHERE AND WHEN THE OFFENDING POLLUTANTS ORIGINATE AND ALMOST COMPLETELY ELIMINATE THOSE EMISSIONS. EMISSION SOURCES THAT DO NOT CONTRIBUTE TO THE ACIDITY IN SENSITIVE SPOTS MAY NOT NEED TO REDUCE THEIR EMISSIONS. WHILE THE HASTY ADOPTION OF REGIONAL UNIFORM POLICIES ON ACID RAIN MAY BE POLITICALLY EXPEDIENT, SOME PATIENT RESEARCH IN SELECTED KEY AREAS SHOULD MAKE POSSIBLE POLICIES THAT ARE MORE ENVIRONMENTALLY SOUND AND COST-EFFECTIVE. THE M.I.T. INVESTIGATORS ARE NOW ENGAGED IN RESEARCH THAT MAY SHOW ECONOMICAL AND RATIONAL ALTERNATIVES FOR THE NEAR FUTURE.

HUBBARD BROOK EXPERIMENTS

IT HAS OFTEN BEEN SAID THAT RAIN HAS BECOME INCREASINGLY ACIDIC IN THE NORTHEAST, PARTICULARLY IN NEW YORK'S ADIRONDACKS. BUT WHERE THE DATA ARE MOST EXTENSIVE, THIS IS NOT SUPPORTED. THE LONGEST CONTINUOUS RECORD OF RAIN pH IS THAT FROM HUBBARD BROOK EXPERIMENTAL FOREST IN NORTH CENTRAL NEW HAMPSHIRE FROM 1963 TO 1978, WITH NO SIGNIFICANT LONG-TERM TRENDS OVER THE FIFTEEN YEAR SPAN.

NATIONAL ACADEMY OF SCIENCES

THE JUNE 1983 NATIONAL ACADEMY OF SCIENCES REPORT ENTITLED "ACID DEPOSITION - ATMOSPHERIC PROCESSES IN EASTERN NORTH AMERICA" HAVE BEEN HAILED BY PRO-ACID RAIN LEGISLATION SUPPORTERS AS CONCLUSIVE PROOF THAT AN ACID RAIN CONTROL STRATEGY, IN THE FORM OF SULFUR DIOXIDE EMISSION REDUCTIONS, SHOULD BE ENACTED IMMEDIATELY. THESE PROPONENTS OF ACID RAIN LEGISLATION MAINTAIN THE NATIONAL ACADEMY REPORT PROVES THAT FURTHER RESEARCH IS NOT NEEDED AND THAT SULFUR DIOXIDES WILL REDUCE RAINFALL ACIDITY. THE BASIS, OF COURSE, FOR THEIR POSITION IS THE REPORT'S CONCLUSIONS THAT "THERE IS NO EVIDENCE FOR A STRONG NON-LINEARITY IN THE RELATIONSHIPS BETWEEN LONG-TERM AVERAGE EMISSIONS (SULFUR DIOXIDES) AND DEPOSITION," AND THAT "THE OCCURENCE OF ACID RAIN IN EASTERN NORTH AMERICA APPEARS TO BE ROUGHLY PROPORTIONAL TO THE AVERAGE ANNUAL EMISSION OF SULFUR DIOXIDE FROM POWER PLANTS, INDUSTRIAL FACILITIES AND OTHER SOURCES IN THAT REGION."

ALMOST IMMEDIATELY AFTER THE REPORT WAS MADE PUBLIC THE CHAIRMAN OF THE COMMITTEE WHICH PREPARED THE ACADEMY'S REPORT MADE IT CLEAR IN PUBLIC STATEMENTS ABOUT THE REPORT THAT IT WAS NOT POSSIBLE TO PREDICT THE IMPACT OF SULFUR EMISSION REDUCTIONS IN SPECIFIC GEOGRAPHIC LOCATIONS ON DISTANT SENSITIVE REGIONS. THE REPORT DID REACH THE CONCLUSION THAT HIGH PRIORITY BE GIVEN TO RESEARCH OF THE PROBLEM RELATING EMISSIONS FROM A GIVEN REGION TO DEPOSITIONS IN A DISTANT RECEPTOR REGION. EMPHASIZING THE IMPORTANCE OF LOCAL SOURCES, THE REPORT STATED THAT AS A RULE OF THUMB THAT "THE FURTHER

THE SOURCE IS FROM A GIVEN RECEPTOR SITE, THE SMALLER ITS INFLUENCE ON THAT SITE WILL BE PER UNIT MASS EMITTED."

ADDITIONALLY, THE NATIONAL LABORATORY CONSORTIUM - COMPOSED OF THE ARGONNE, BROOKHAVEN, OAK RIDGE AND PACIFIC NORTHWEST NATIONAL LABS - FOUND MAJOR "FLAWS" IN THE MUCH-TOUTED ACID RAIN STUDY BY THE NATIONAL ACADEMY OF SCIENCES. THE NAS STUDY REPORTED TO SHOW THAT REDUCTIONS IN SULFUR DIOXIDE EMISSIONS RESULT IN A "LINEAR," REDUCTION ON ACID DEPOSITION. THE CONSORTIUM SAID IT "DISAGREED MOST UNIFORMLY WITH THE METHODS USED TO REACH THIS CONCLUSION AND WITH THE CONCLUSION ITSELF." IT ADDED: "THE CONCLUSION OF A LINEAR REMOVAL MECHANISM FOR SULFUR DIOXIDE IS NOT SUPPORTABLE."

U.S./CANADA MEMORANDUM OF INTENT

THE SCIENTISTS WORKING UNDER THE UNITED STATES/CANADA MEMORANDUM OF INTENT FOUND THAT EVEN IF SULFATE DEPOSITION IS REDUCED AND THE LONG-TERM ACIDIFICATION IS REVERSED, IT IS NOT KNOWN WHETHER NITRATE DEPOSITION MAY NEED TO BE REDUCED AS WELL IN ORDER TO PROTECT ALL BUT THE MOST SENSITIVE SURFACE WATERS. ONE OF THE MAJOR RESEARCH PROJECTS NOW UNDERWAY IS A COMPILATION OF ALL HISTROICAL DATA AVAILABLE. THIS STUDY WILL ALSO INCLUDE A DETERMINATION AND EVALUATION OF TRENDS IN ACIDITY WHERE SUFFICIENT HIGH-QUALITY HISTORICAL DATA ARE AVAILABLE. AT PRESENT, DATA FROM LAKES WHICH HAVE BEEN ACIDIFIED AND FOR WHICH HISTORICAL DATA ARE AVAILABLE DO NOT INDICATE A RAPID RATE OF CHANGE EITHER IN TERMS OF ALKALINITY OR pH.

LAKE RECOVERY TIME

THE LENGTH OF TIME REQUIRED FOR A LAKE ACIDIFIED BY ACID DEPOSITION TO RECOVER IS A SUBJECT OF MUCH SCIENTIFIC SPECULATION. THE TIME OF RECOVERY COULD BE MEASURED IN TERMS OF DECADES. HOWEVER, SOME SCIENTISTS BELIEVE THAT CERTAIN LAKES AND STREAMS IN THE NORTHEAST COULD RECOVER IN AS SOON AS 5-10 YEARS.

FOREST PRODUCTIVITY

THERE IS ALSO CONCERN OVER THE EFFECTS OF ACID DEPOSITION ON FOREST PRODUCTIVITY. AMONG THE HYPOTHESES UNDER INVESTIGATION ARE THAT ACID DEPOSITION OR CONCENTRATION OF SULFUR DIOXIDE OR OTHER POLLUTANTS SUCH AS OZONE MAY BE DAMAGING THESE TREES. THE POSSIBILITY OF A RELATIONSHIP BETWEEN POLLUTANTS AND DROUGHT IS ALSO BEING INVESTIGATED. RESEARCH ON ACID DEPOSITION EFFECTS IN HIGH ELEVATION FORESTS HAS BEEN INITIATED BY THE GOVERNMENT. EVIDENCE TO TEST THE VARIOUS HYPOTHESES ON THE EFFECTS OF ACID RAIN ON FOREST PRODUCTIVITY IS BEING COLLECTED IN THE EASTERN UNITED STATES. CORE SAMPLES ARE BEING TAKEN FROM OVER 50 FOREST STANDS TO CORRELATE GROWTH WITH CLIMATE, TRACE METAL CONTENT OF THE WOOD, AND ANTHROPOGENIC POLLUTANTS SUCH AS O_3, SO_2 AND ACID RAIN.

CROP SPECIES IMPACT

ANALYSIS OF EXPERIMENTAL RESULTS FROM FIELD AND CONTROLLED ENVIRONMENT EXPERIMENTS INDICATES THAT THE MAJORITY

OF CROPS SPECIES EXPERIENCE NO EFFECTS ON GROWTH OR YIELD AS A RESULT OF EXPOSURE TO SIMULATED ACID RAIN. AVAILABLE EXPERIMENTAL RESULTS DO NOT SHOW A PATTERN OF EITHER NEGATIVE OR POSITIVE EFFECTS OF ACID PRECIPITATION. THESE EXPERIMENTAL DESIGNS ARE NOT SUFFICIENT TO ESTABLISH CONCLUSIVE RESULTS AS OF THIS TIME. ADDITIONAL CROPS AND AGRUCULTURAL CONDITIONS ARE NOW BEING STUDIED AS PART OF THE NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM.

ACID RAIN PERCURSORS

THERE IS A VOLUME OF SCIENTIFIC EVIDENCE WHICH INDICATES THAT THE COMPLEX ATMOSPHERIC RELATIONSHIP BETWEEN ACID RAIN PERCURSORS INVOLVES MORE THAN ONE POLLUTANT. IN ADDITION TO SULFUR DIOXIDE AND NITROGEN OXIDES PHOTOCHEMICAL OXIDANTS SUCH AS OZONE AND HYDROGEN PEROXIDE, AND REACTIVE VOLATILE ORGANIC COMPOUNDS ARE KNOWN TO PLAY A ROLE IN TRANSFORMATION AND CAN BE CONSIDERED TO BE ADDITIONAL PERCURSORS OF ACID DEPOSITION. EFFORTS ARE UNDERWAY IN THE RESEARCH PROGRAM OF THE ENVIRONMENTAL PROTECTION AGENCY TO QUANTIFY THE ROLE OF ALL OF THEIR PERCURSORS IN THE FORMATION AND DEPOSITION OF ACIDIC COMPOUNDS.

DRY DEPOSITION

DRY DEPOSITION, AT PRESENT, CAN NOT BE ACCURATELY MEASURED BY ROUTINE MONITORING TECHNIQUES. DRY DEPOSITION IS

BELIEVED TO CONTRIBUTE TO MORE THAN HALF OF THE ACIDITY TO EASTERN NORTH AMERICA. AN INTENSIVE RESEARCH EFFORT IS UNDERWAY TO DEVELOP AN INDIRECT MONITORING APPROACH WHICH WILL ESTIMATE DRY DEPOSITION FROM MEASUREMENTS OF ATMOSPHERIC CONCENTRATIONS OF THE DEPOSITED SPECIES AND ESTIMATES OF DEPOSITION RATES FOR THE DIFFERENT TYPES OF TERRAIN. A PILOT PROJECT USING THIS APPROACH WILL BE ESTABLISHED DURING 1984 AND 1985.

OIL COMBUSTION AND ACID RAIN

ACCORDING TO THE EPA'S ACID DEPOSITION TASK FORCE, FIELD MEASUREMENTS HAVE SHOWN THAT A LARGER FRACTION OF SO_2 IS EMMITTED AS SURFURIC ACID FROM OIL COMBUSTION THAN FROM COAL-BURNING. RESULTS FROM AN EXTENSIVE SERIES OF SOURCE EMISSIONS FROM OIL COMBUSTION ARE 5 TO 10 TIMES HIGHER THAN THOSE FROM COAL OF A SIMILAR SULFUR CONTENT. THUS, ACCORDING TO THE REPORT, PRIMARY SULFATES FROM OIL COMBUSTION APPROXIMATE THOSE FROM COAL COMBUSTION AT THE NATIONAL LEVEL AND CAN BE MORE IMPORTANT IN SOME LOCALITIES. A BETTER UNDERSTANDING OF THE ROLE OF PRIMARY SULFATE EMISSIONS TO ACID DEPOSITION IS NEEDED TO ASSESS THE RELATIVE CONTRIBUTIONS OF DISTANT VS. LOCAL SOURCE EMISSIONS TO DEPOSITION.

MONITORING NETWORKS

IN THE UNITED STATES, DEPOSITION MEASUREMENTS HAVE BEEN MADE ONLY SINCE 1955 AND EVEN THEN ONLY ON AN INTERMITENT BASIS.

THE CURRENT WET DEPOSITION MONITORING NETWORKS HAVE BEEN OPERATING 1 TO 4 YEARS. DRY DEPOSITION HAS NEVER BEEN MEASURED ACCURATELY IN A MONITORING NETWORK. CONSEQUENTLY, MOST CONCLUSIONS ABOUT HISTORICAL TRENDS IN DEPOSITION AND ACIDIFICATION ARE BASED ON LIMITED EVIDENCE. ONE OF THE MAJOR CURRENT FEDERAL RESEARCH EFFORTS IS ATTEMPTING TO DETERMINE THE NUMBER OF LAKES IN WHICH ACIDITY HAS CHANGED, TOGETHER WITH THE DIRECTION AND MAGNITUDE OF THESE CHANGES. THE CONCLUSION OF THE ACID DEPOSITION TASK FORCE OF THE EPA WAS THAT "GIVEN THE CURRENT STATE OF KNOWLEDGE, IT IS NOT POSSIBLE TO SAY WHETHER OR NOT CURRENT LEVELS OF ACID DEPOSITION WILL LEAD TO INCREASING NUMBERS OF ADVERSELY AFFECTED LAKES AND STREAMS."

NATIONAL TRENDS NETWORK (NTN)

THE INTERAGENCY TASK FORCE ON ACID PRECIPITATION HAS INSURED THAT THE ABILITY TO MONITOR WET DEPOSITION NOW EXISTS IN THE UNITED STATES. A 150 STATION NATIONAL WET DEPOSITION MONITORING NETWORK, THE NATIONAL TRENDS NETWORK (NTN) IS NOW BEING ESTABLISHED. OVER 100 STATIONS ARE CURRENTLY OPERATIONAL. THE NTN WAS DESIGNED TO PROVIDE COVERAGE OF THE ENTIRE CONTIGUOUS UNITED STATES AND TO PROVIDE REPRESENTATIVE INFORMATION ON THE PRECIPITATION FALLING ON ALL MAJOR ECOLOGICAL ZONES.

SOURCE/RECEPTOR RESEARCH

RESEARCH IS ALSO CONTINUING IN DETERMINING DEFINITIVE SOURCE/ RECEPTOR RELATIONSHIPS. THE TWO APPROACHES ARE COMPREHENSIVE MODELING AND COMPREHENSIVE FIELD EXPERIMENTS. THE FIELD EXPERIMENT APPROACH IS BEING CONSIDERED BY THE INTERAGENCY TASK FORCE ON ACID PRECIPITATION IN ITS 1985 BUDGET. THE NATIONAL CENTER FOR ATMOSPHERIC RESEARCH (NCAR), UNDER THE INTERAGENCY AGREEMENT WITH THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, PROCEEDED WITH CONSTRUCTION OF A REGIONAL ACID DEPOSITION MODEL (RADM) IN JUNE 1983.

U.S. RESEARCH DOLLARS: NPAP

THE DOLLARS COMMITTED BY THE UNITED STATES GOVERNMENT THROUGH THE NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM OVER THE LAST FIVE FISCAL YEARS IS SUBSTANTIAL. FOR THE FISCAL YEARS 1980 TO 1984 CONGRESS APPROPRIATED $93 MILLION. THE RECOMMENDATION FROM THE WHITE HOUSE FOR 1985 IS $55.5 MILLION PLUS AN ADDITIONAL SUPPLEMENTAL REQUEST FOR FISCAL YEAR 1984 BUDGET OF $5.5 MILLION. ADDITIONALLY, WE STRONGLY SUPPORT THE DEVELOPMENT OF NEW TECHNOLOGY IN WORKING TOWARDS A COST-EFFECTIVE CONTROL STRATEGY. INCLUDED WITHIN THE BUDGET RECOMMENDATION OF THE ADMINISTRATION TO THE CONGRESS FOR FISCAL YEAR 1985 IS A REQUEST FOR $67 MILLION FOR THE PURPOSE OF NEW TECHNOLOGY DEVELOPMENT.

INDIANA'S RESEARCH EFFORT

WE HAVE JUST DEDICATED A $6 MILLION, 2 YEAR PILOT PROJECT HERE IN INDIANAPOLIS TO TEST A NEW, DRY SCRUBBER PROCESS. BY COMBINING AMMONIA AND ELECTRON BEAMS THROUGH POST COMBUSTION SCRUBBING, 90% OF THE SULFUR DIOXIDE AND 90% OF THE NITROGEN OXIDES WILL BE REMOVED AND THE BY-PRODUCT WILL BE A COMMERCIALLY SALABLE FERTILIZER. THIS HOLDS GREAT PROMISE FOR THE ELECTRIC UTILITY INDUSTRY WHICH GENERALLY VIEWS THE PRESENT SCRUBBER TECHNOLOGY AS BEING INEFFICIENT, EXPENSIVE AND PRODUCTIVE OF A BY-PRODUCT WHICH IS DIFFICULT TO WORK WITH AND UNWIELDLY IN ITS DISPOSAL.

MITIGATION EFFORTS

WE ALSO SUPPORT THE 5 MILLION DOLLAR RECOMMENDATION OF THE REAGAN ADMINISTRATION FOR AN EXPERIMENTAL PROGRAM TO HELP RESTORE THE BUFFERING CAPACITY THAT HAS BEEN REDUCED AND AFFECTED LAKES OVER THE YEARS. AS WE UNDERSTAND IT, THE PROGRAM WILL BE ADMINISTERED BY THE U.S. FISH AND WILDLIFE SERVICE AND WILL BE CLOSELY TIED TO THE OVERALL RESEARCH EFFORT. WHILE WE RECOGNIZE THAT THIS MITIGATION THROUGH LAKE LIMING IS A SHORT-TERM INTERIM SOLUTION TO THE OVER-ALL PROBLEM, EVEN ACCORDING TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, THE BENEFITS OF POND LIMING USUALLY LAST ABOUT 3 TO 5 YEARS AND ARE MOST EFFECTIVE IN WATERS HAVING VERY LOW FLUSHING RATES. THE 3 TO 5 YEARS OF PROTECTION FOR THE LAKES AND PONDS OF THE ADIRONDACKS WILL PROVIDE IMPORTANT TIME FOR ADDITIONAL RESEARCH AND TIME FOR IMPROVED TECHNOLOGY.

KENTUCKY FLUID BED COMBUSTION PROJECT

WE THINK IT IS IMPORTANT TO NOTE THAT THE STATE OF KENTUCKY HAS EMBARKED ON A $200 MILLION PROJECT TO TEST A UTILITY SIZED FLUID COMBUSTION BED BOILER. THE 220 MEGAWATT UNIT IS BEING JOINTLY BUILT BY DUKE POWER, THE TENNESSEE VALLEY AUTHORITY AND THE ELECTRIC POWER RESEARCH INSTITUTE. THIS TECHNOLOGY, LIKE THE EBARA DRY SCRUBBER PROJECT HERE IN INDIANAPOLIS, HOLD GREAT PROMISE FOR THE HIGH SULFUR COAL PRODUCING STATES AND THE ELECTRIC UTILITIES WHO ARE DEPENDENT UPON THIS COAL TO FIRE THEIR BOILERS.

A LOOK AT CANADA

WE WOULD ALSO LIKE TO TAKE NOTE OF CERTAIN ACTIONS AND LACK OF ACTIONS FROM OUR FRIENDS FROM CANADA. BECAUSE THE CANADIAN ECONOMY HAS A GREAT STAKE IN ITS COMMERCIAL FOREST RESOURCES, THE FOREST INDUSTRY IS IN A UNIQUE POSITION IN THE CURRENT DEBATE. ON THE ONE HAND, THE MANUFACTURING FACILITIES OF THE FOREST INDUSTRY EMIT SULFUR AND NITROGEN OXIDES THAT ARE THOUGHT TO BE THE PERCUSORS OF ACID DEPOSITION. THUS, IF THERE ARE SULFUR DIOXIDE AND NITROGEN OXIDE EMISSION CONTROL MEASURES MANDATED IN CANADA THIS INDUSTRY WILL BEAR A SIGNIFICANT SHARE OF THE CONTROL COST UNDER CURRENT PROPOSALS. ON THE OTHER HAND, THE INDUSTRY'S RAW MATERIAL BASE IS IN THE FORESTS AND EVEN A SMALL REDUCTION IN FOREST PRODUCTIVITY RESULTING FROM ACID RAIN WOULD CONSTITUTE A MAJOR ADVERSE IMPACT. SO, HOW DOES THE CANADIAN FOREST INDUSTRY

FEEL ABOUT THE ACID RAIN QUESTION? THE FOREST INDUSTRY BELIEVES THAT ACID DEPOSITION CAN RANGE FROM BENEFICIAL TO ADVERSE, OR PERHAPS BE NON-DETECTABLE, AND THAT ONLY FURTHER RESEARCH WILL DETERMINE THIS. THE INDUSTRY THEREFORE CONCLUDES THAT "THE CURRENT STATE OF KNOWLEDGE DOES NOT ALLOW ANY DEFINITIVE CONCLUSIONS TO BE REACHED REGARDING THE AFFECTS OF ACID DEPOSITION ON FOREST PRODUCTIVITY."

WHILE THE UNITED STATES HAS ENACTED THE CLEAN AIR ACT OF 1970, AND THE AMENDMENTS OF 1977, BRINGING TO THE NATION THE NATIONAL AMBIENT AIR QUALITY STANDARDS, NEW SOURCE PERFORMANCE STANDARDS, BEST AVAILABLE CONTROL TECHNOLOGY REQUIREMENTS, PREVENTION OF SIGNIFICANT DETERIORATION PROGRAMS, BEST AVAILABLE RETROFIT TECHNOLOGY REQUIREMENTS, AND STATE IMPLEMENTATION PLANS, THE CANADIAN PREFERENCE IS FOR LOW KEY INTERGOVERNMENTAL AND CORPORATE-GOVERNMENTAL NEGOTIATIONS.

THE INDIANA COAL INDUSTRY ALSO HAS NOTICED THE POSITION OF NOVA SCOTIA. LIKE INDIANA, NOVA SCOTIA IS AN ECONOMICALLY DEPRESSED BUT COAL RICH PROVINCE. IT HAS PINNED MUCH OF ITS HOPE FOR ECONOMIC RECOVERY AND PROSPERITY ON A REJUVINATION OF ITS LONG TRADITION OF COAL MINING AND A SHIFT IN ITS DOMESTIC ENERGY DEPENDENCY FROM EXPENSIVE OPEC OIL TO ITS OWN CHEAPER COAL. SULFUR CONTENT OF NOVA SCOTIA COAL IS EVEN HIGHER, GENERALLY, THAN THAT HERE IN INDIANA. IT IS ABOUT 5% SULFUR. IN ADDITION TO ITS COAL MINING INDUSTRY, NOVA SCOTIA ALSO HAS AN IMPORTANT FISHERY IN THE SOUTHEASTERN PART AND ALSO FOREST PRODUCTIVITY WHICH PROVIDES JOBS. YET, ACCORDING TO JOHN E.

CARROLL IN HIS BOOK ENTITLED "ACID RAIN: AN ISSUE IN CANADIAN - AMERICAN RELATIONS" , "NOVA SCOTIA'S GREATEST FEAR, HOWEVER, IS FOR ITS COAL PROSPECTS, AND IT THUS BELIEVES THAT THE STAKES ARE SUFFICIENTLY HIGH TO JUSTIFY MUCH MORE RESEARCH GENERATING HARD DATA BEFORE COSTLY REGULATORY DECISIONS CAN BE MADE."

VIEWS OF AN EASTERN GOVERNOR

HERE IN THE UNITED STATES I THINK IT IS ALSO IMPORTANT TO LOOK TO THE NORTHEAST AND WHAT ONE OF THE LEADERS IN THAT AREA OF THE COUNTRY HAS SAID ABOUT THE ACID RAIN ISSUE. IN HIS TESTIMONY BEFORE CONGRESS IN 1980, MAINE GOVERNOR JOSEPH BRENNAN RAISED CONCERNS ABOUT THE STATE'S GEOGRAPHICAL POSITION AND HIGH LEVEL OF VULNERABILITY. WHILE CITING THE INADEQUACY OF THE CLEAN AIR ACT TO ADDRESS THE PROBLEM, GOVERNOR BRENNAN ENDED ON A NOTE OF CAUTION IN HIS TESTIMONY, FINDING ACID RAIN TO BE "FAR TOO COMPLEX A PROBLEM TO BE ADDRESSED WITH QUICK FIXES, AND THE ECONOMIC COST OF OVER-REACTION MAY BE JUST AS GREAT AS THE COST OF A FAILURE TO ACT." HE URGED SCIENTIFIC AND ECONOMIC RESEARCH AS AN ESSENTIAL FOUNDATION FOR LEGISLATIVE ACTION.

U.S. SCRUBBER INSTALLATION COSTS

WE ALSO THINK THAT ITS IMPORTANT TO NOTE THAT THE UNITED STATES HAS INSTALLED 87 SCRUBBERS AT A COST OF $4 BLLION WITH

ANNUAL OPERATING EXPENSES OF $1.7 BILLION.HOWEVER, ONLY RECENTLY HAVE THE CANADIANS EVEN AGREED TO PUT ON THEIR FIRST SCRUBBER. ONTARIO HYDRO ANNOUNCED IN 1981 THAT THE UTILITY WOULD SPEND $500 MILLION BY TRIMMING SULFUR DIOXIDE EMISSIONS BY 40% IN THE NEXT 10 YEARS THROUGH THE INSTALLATION OF TWO SCRUBBERS BY 1987 AT ONE OF TWO MAJOR COAL-FIRED GENERATING STATIONS.

H.R. 3400

I WOULD NOW LIKE TO ADDRESS WHAT WE BELIEVE ARE THE SHORTCOMINGS OF H.R. 3400.

FIRST, THE ALLOCATION FORMULA IN H.R. 3400 DISTRIBUTES THE EMISSION REDUCTION DISPROPORTIONALELY ON A GEOGRAPHIC BASIS. THIS FORMULA DOES NOT REFLECT THE SPATIAL RELATIONSHIP OF EMISSION SOURCES AND THE AREAS KNOWN TO BE SENSITIVE TO ACID DEPOSITION. SECOND, BY ARBITRARILY SELECTING THE 50 LARGEST EMITTING POWER PLANTS, THE BILL FURTHER DISTORTS ANY LOGICAL CORRELATION BETWEEN GROSS EMISSIONS AND SENSITIVE RECEPTOR AREA IMPACTS. ALSO, BECAUSE THE FORMULA EXEMPTS OR REQUIRES ONLY MINIMAL EMISSIONS REDUCTIONS FROM 21 OF THE 48 STATES, INCLUDING STATES IN THE MOST SENSITIVE REGIONS, SIGNIFICANT ECONOMIC AND SOCIAL BURDENS WILL BE CONCENTRATED IN THOSE AREAS OF THE COUNTRY STILL SUFFERING FROM ECONOMIC RECESSION.

THERE IS A COMPOUNDED IMPACT ESPECIALLY HITTING OUR INDIANA CITIZENS. FIRST, ALL OF THE INDIANA RATE PAYERS WILL PAY

THE COSTS IN ESTABLISHING THE EMISSIONS CONTROL EQUIPMENT TRUST FUND. SECONDLY, THE EXPENSES FOR OPERATION AND MAINTENANCE OF THE CONTROL EQUIPMENT WILL NEED TO BE SEPARATELY RECOUPED, AGAIN FROM INDIANA RATEPAYERS. FINALLY, THE UNEMPLOYMENT IMPACT AND INCREASED INDUSTRIAL COSTS WILL ALSO HAVE AN ADVERSE IMPACT ON THE STATE OF INDIANA.

BY 1995, INDIANA COAL PRODUCTION WILL GROW FROM ITS 1980 LEVEL OF 30 MILLION TONS TO 47 MILLION TONS. UNDER H.R. 3400 PRODUCTION GROWTH WILL DECREASE BY 7 MILLION TONS - A 16% DECREASE. ADDITIONALLY, THIS ANALYSIS ASSUMES THAT ALL OF THE INDIANA ELECTRIC UTILITIES REQUIRED TO RETROFIT SCRUBBERS WILL DO SO. IN FACT, HOWEVER, MANY OF THE PLANTS BECAUSE OF AGE AND PHYSICAL CONSTRAINTS WILL SIMPLY BE PREMATURELY RETIRED. A STUDY DONE FOR EDISON ELECTRIC INSTITUTE ESTIMATES THAT 6 MILLION TONS OF INDIANA COAL CONSUMPTION COULD BE LOST DUE TO THE PREMATURE RETIREMENT BY THESE PLANTS. ADDITIONALLY, THIS ANALYSIS ALSO ASSUMES THAT THERE WILL NOT BE A FURTHER INCREASE IN THE USE OF WESTERN COAL BY INDIANA UTILITIES. IN FACT, 4.5 MILLION TONS OF WESTERN COAL WERE USED BY INDIANA ELECTRIC UTILITIES IN 1980. THERE IS NOTHING TO INDICATE THAT THAT GROWTH OF WESTERN COAL BEING USED BY INDIANA UTILITIES WILL NOT CONTINUE. THUS, THERE IS STRONG EVIDENCE THAT UNDER H.R. 3400, THERE MAY ACTUALLY BE A DECLINE IN INDIANA COAL PRODUCTION.

CONCLUSION

WE APPRECIATE THE OPPORTUNITY OF BEING ABLE TO PROVIDE THE SUBCOMMITTEE WITH THIS WRITTEN STATEMENT. SCIENTIFIC RESEARCH AND IMPROVED TECHNOLOGY WILL PROVIDE A SOUND BASIS FOR MOVING FORWARD WITH THIS COUNTRY'S STATED GOAL OF CONTINUING TO IMPROVE ON OUR ENVIRONMENT. EXPENSIVE AND DIVISIVE CONTROL PROGRAMS, LACKING A SOLID, SCIENFITIC FOUNDATION, WILL NOT HELP OUR NATION'S ENVIRONMENTAL EFFORTS OR OUR ECONOMIC RECOVERY.

Mr. WAXMAN. Thank you very much. I want to thank each of you and commend you for your testimony and the points you have raised that are a concern to us.

Mr. Maguire, on your last point, you indicate that you think that there will be a phasing out of these old powerplants rather than use of scrubbers, but the American Electric Power testified before the Senate that they plan to run these plants for 50 to 60 years. The information we have is that it would be 10 times less expensive to retrofit with scrubbers than to build new powerplants.

I wanted to point that out to you and see if you have any reaction to that.

Mr. MAGUIRE. Mr. Chairman, my only reaction is that a study done for Edison Electric Institute by Temple, Barker & Sloan indicated a number of plants in Indiana, either because of physical constraints or age, would be retired.

So, I can't speak to that AEP study, but I do know that I have read for EEI.

Mr. WAXMAN. I think both you and Mr. Stilwell pointed out that 4.5 million tons of western coal were used by electric utilities in 1980, and that's over a thousand jobs already lost, with more losses to come, if we continue to ignore this problem and not support legislation that will protect your coal base.

Can you both agree to the proposition that, because H.R. 3400 would protect the coal base, that there is an advantage from that aspect to the legislation?

Mr. STILWELL. I'm not sure that it would necessarily protect the coal base. I see a possibility—and it's very difficult to look into the future—but I see a possibility on six of these listed plants here. Some of these plants were built in 1950. They will be 40 years old by 1990. I can see the potential for those plants being actually shut down that use presently this midwestern coal.

To make up the need for the megawatts lost in those plants, I think, perhaps, that some of the utilities would dig into their excess generating capacity that they already have, but we just have a net loss of jobs. I think that's certainly within the realm of possibility.

I might point out one example; Indiana-Michigan Rockport plant is going online in 1984. In 1986, it will be 2600 megawatts of electricity. Their plans are to import all western coal from Wyoming. They do not fall under the standards of the 1977 revisions of the Clean Air Act, and they do not have to have scrubbers put on that particular facility.

Two plants of the top seven in Indiana are owned by I&M. I'm fearful that if those plants are mandated to put on scrubbers—the average of those plants is in excess of 35 years—that they will retire those plants, and we'll lose the jobs that we have for those plants to the new I&M Rockport facility, and that's my concern, Mr. Chairman.

Mr. WAXMAN. I understand that concern, and, of course, you have to realize that those new plants would have to have those scrubbers, because under the present law, new source performance standard requirements of the Clean Air Act mandate that they build the plants with those scrubbers in place.

Mr. **Stilwell**. Yes, sir. Mr. Chairman, I do understand that. But in reference to what I just made, this particular plant is not required, and I don't know the legalities of it.

All I know is that I think there was some court action to determine whether or not they had to have scrubber technology put on. It's going online in December 1984 for the first unit, and the second unit, 1986.

They will not, and do not have, scrubbers on this plant coming online, and they will be using 100 percent western Wyoming coal, and that's what our concern is.

Mr. **Waxman**. Mr. Sharp.

Mr. **Sharp**. My only question that I would have, and I don't know what the answer is, and it would be interesting for us in Indiana to find out, is, if these plants are going online and they have this new capacity, are you sure that the utilities are not going to close down those old plants anyway. I mean, at some point, they've got to calculate the economics of that, whether Congress does a thing about acid rain or not, because it sounds as if what you are saying is the utilities, as is the case in many parts of this country, have over built because they expect a greater demand. So, they're all scrambling, as Public Service of Indiana, unfortunately, is having to do at the moment, to figure out what to do about the excess capacity.

My problem is the phenomenon you raise that what you fear from this legislation may happen anyway, because those utilities, and, certainly, the Public Service Commission of Indiana, on behalf of rate payers in this State, ought to be looking very hard at the economics of how the excess capacity is used in this State and anywhere. I mean this State is their responsibility.

Mr. **Stilwell**. It very well may happen anyway, and I would propose at some point in the future, it, in fact, would happen. My fear is that H.R. 3400 would only accelerate the closing of those plants.

Mr. **Waxman**. Well, I understand that fear, and I would have to look at what American Electric Power said to the Senate of the United States. They're talking about running these plants for 50 to 60 years, and it's 10 times less expensive to just put the retrofits on. So, we've got to make some clear evaluation of that.

Mr. Stilwell, I thought your testimony was excellent. And I know we share the same feelings on the importance of preserving jobs, and protecting human health, and our environment, but I'm disturbed by the projections that utilities are switching to low-sulfur coal, even in the absence of acid rain legislation.

This means, of course, that if we don't act, jobs will probably be lost. I know you're aware of that trend, and share that concern as well.

Mr. **Stilwell**. We're fearful, with acid rain legislation, particularly H.R. 3400. I think it spells out quite specifically how we're going to achieve a 7-million-ton reduction. I think we're trying to look into the future of what might or might not happen.

The 3-million-ton reduction, I think, as I understand it, the States use their collective wisdom and decide how they want to reduce or how they're going to encourage to reduce those 3 million tons.

It's my belief that the plants who aren't targeted for scrubbers that some of them, perhaps built in the 1970's, would, in fact, to reduce within this 3 million tons, would go to a low-sulfur Western compliance coal.

Historically, in the State of Indiana, we have seen that happen within the past few years also.

Mr. WAXMAN. Of course, this legislation puts money in to subsidize the technology to preserve use of high-sulfur coal, so we're bending over to be favorable toward the use of high-sulfur coal as opposed to a bill, for example, that was introduced just yesterday in the House of Representatives by Representative Rinaldo, who's on the Commerce Committee, who is looking to unlimited fuel switching as the way to deal with the problems of acid rain.

Of course, that's the kind of approach that we're trying to counter.

I do appreciate the testimony.

Mr. Maguire, do you want to add something?

Mr. MAGUIRE. Yes. Congressman Waxman, if I could just point out one thing. Under projections for growth in Indiana coal production and use by 1995, it's projected to be 46.8 million tons. So, I don't think the concern for western coal coming into the State is going to have any significant impact. We don't view this legislation as protecting the Indiana coal market.

Mr. WAXMAN. You don't see fuel switching going on at the present time?

Mr. MAGUIRE. There is some. There's about 4.5 million tons, as I indicated, of western coal coming into the State. I don't think there will be any significant increase in that.

Mr. WAXMAN. Why not?

Mr. MAGUIRE. Well, I think the utilities are at or near their emission requirements under the present law, and I believe that the new plants that are on-line here are using Indiana coal, and just the growth and the use for those plants—we have a number of plants in Indiana with scrubbers on them already.

Mr. WAXMAN. Of course, if the Senate bill passes, your statement would be——

Mr. MAGUIRE. A world of hurt.

Mr. WAXMAN. Mr. Sharp.

Mr. SHARP. Thank you, Mr. Chairman.

I appreciate the testimony. I think it does bring out that there are lots more specific things we can find out.

Obviously, the 50 plants have been identified, and we ought to be able, over time—and some of the data has already been developed—identify more clearly what is economically likely to happen with respect to those 50 plants.

I think Mr. Stilwell is correct in raising the 3 million tons of sulfur dioxide, under the legislation, it has to be dealt with. I don't yet have a clear appreciation for how that will be distributed among the States, and what percentage of it comes to Indiana, which will clearly be higher than many States, because we're viewed as a stronger emitter of SO_2, and how that would be applied here in the State, and I think those are questions that we need to develop a good data base on.

The AEP, of course, is the parent company—you've been quoting them—of Indiana-Michigan Electric here in this State, and, so, it's giving a national average statistic, but I'm sure what we need to ultimately get to is not just the national average statistic on life of plants, but the specific ones that we know will be affected. But I appreciate the testimony of the people.

Mr. WAXMAN. Mr. Coats.

Mr. COATS. I'm trying to get this sorted out in my mind in terms of the impact on coal mining jobs.

Now, you've indicated a 7-million-ton decrease if H.R. 3400 is enacted, and the chart back here indicates a 10-million increase, so we're talking about a 17-million-ton difference. Is that correct, as I've restated your position?

Mr. STILWELL. I think Mr. Maguire referred to the——

Mr. COATS. That's right. That's right.

Mr. STILWELL. However, I don't feel that I'm in a place to, perhaps, ask questions, but I'm concerned with the figures, and I'm very encouraged, and I certainly hope these figures do come to pass in 1995; that, in fact, here in Indiana, that we have 12,000 coal miners employed in our industry here in Indiana, as those charts reflect.

What concerns me is how do we get to 12,000 coal miners under this particular piece of legislation, and then we only get to 40 million tons of coal production. My figures would lead me to believe that that 7,000 additional workers to produce only an additional 10 million tons of coal that that equates to approximately 1,500 tons per miner per year.

Mr. COATS. Well, the figure I have is more like 270 or 300, somewhere in there, rather than——

Mr. STILWELL. I think it equates to about 1,500 tons per miner per year; however, I would point out that the present standard for productivity for Hoosier coal miners is in excess of 5,000 tons per year per man. And I might also point out, Mr. Chairman, that's the highest productivity in the country for high-sulfur coal.

Mr. COATS. I didn't state that correctly, but did the figure that I have, is that for each 1-million-ton increase in production. It's about 270 jobs; am I close? Is that within the ballpark?

Mr. STILWELL. Yes. More or less, that's right.

Mr. COATS. So, if we're talking about a 10-million-ton increase, we're not talking anywhere near the kind of jobs here, am I wrong, or right, or what?

Mr. STILWELL. I would agree. If you're talking about a 10-million increase, I would agree that somewhere around the range of——

Mr. COATS. 2,500 to 3,000.

Mr. STILWELL [continuing]. 2,500 to 3,000 jobs, somewhere in that range, yes, sir.

Mr. MAGUIRE. I'd agree with that.

Mr. COATS. I wonder if I could defer to the sponsor of the bill to see where the figure was derived that gave us so many more jobs.

The coal mining people here indicate that for each additional million tons mined it results in about 270 jobs. Is this correct?

Mr. WAXMAN. The source of that statistic is the ICF report. ICF, of course, is a firm that has done work for the Department of Energy, the EPA, and the utilities, and they are quite a reputable organization in this field, and this is what they indicate to us as their evaluation.

Mr. COATS. Did you have any input into that study?

Mr. STILWELL. No, sir.

Mr. MAGUIRE. No.

Mr. STILWELL. I refer to our documents, in that, it came from a 1982 U.S. Department of Labor, the Mine Safety and Health Administration, that the average productivity for Hoosier miners is 4,270 tons per man per year, and that's a bit low, because what they did, they took into consideration the underground mines in the regional central area, and we're a surface productive area, so our figures are considerably higher, in excess of 5,000.

Mr. COATS. We ought to get the ICF out here to talk to the Indiana coal miners.

Mr. MAGUIRE. I think the Office of Technology Assessment also uses a figure of around 250, 225 men for each 1-million-ton production on an annual basis.

Mr. SIKORSKI. Or women; men or women.

Mr. SHARP. Mr. Chairman, I just want you to understand our people out here in Indiana are far more productive than some other parts of the country.

Mr. COATS. I think they were measuring that out of Washington's productivity standards.

Mr. SHARP. My colleague, unfortunately, reminds us that the emissions were more productive, too. But I just want you to realize what kind of people we're dealing with.

Mr. SIKORSKI. We did share—I think for the record, Mr. Chairman, I know staff and we shared this information, and the runs from ICF last summer to the mine workers and others. So, this is the first time that we've had any kind of contradiction of that particular statistical——

Mr. SHARP. It's just because we do better than the national average, see, and that's what you have to understand.

Mr. STILWELL. I don't know what the national average is for productivity, but, as Congressman Sharp pointed out, we are, indeed, proud of our high productivity, which is in excess of 5,000 tons per man per year.

Mr. COATS. Thank you. I appreciate that information. I think that it is very important as we look at this bill so that we're aware of just how those statistics come out and what the impact is.

The question for Ms. Hubbard, if I have time left, is there's a real dispute over whether acid rain is getting worse or getting better in the Northeast, and I have seen statistics on both sides.

Did the Hudson Institute study, or any other studies that Hoosiers for Economical Development looked at, give you some indications of which direction we're going?

Ms. HUBBARD. Well, the Hudson Institute study was not a scientific analysis. They were not scientists, and they didn't purport to be. They are a public policy research firm, and they were asked to review all the reports, and studies, and so on, to determine what damage, and their conclusion was that there is insufficient data to say that there is; that definitely there are lakes and streams in the Northeast that are acidified, but as to the causes of those, whether some of them might be from SO_2 emissions in the local areas, or in the Midwest, or from natural causes, soil conditions, and that kind of thing, that there was still significant lack of certainty in the science and in the data to warrant a $100 billion, or very, very expensive acid rain control program.

Mr. COATS. Do you have any information? Did you gather any information that indicated whether or not the lakes and streams were becoming more acidic or less acidic over the past few years?

Ms. HUBBARD. I cannot—I don't know myself.

Do you recall some, David? Do you mind David answering?

Mr. LANTZ. My name is David Lantz, and I'm the research analyst for Hoosiers for Economic Development.

In the National Academy of Sciences report of, I think it was, June 1983, the data collected at a testing site called Hubbard Brook in New Hampshire was cited as the most accurate record of precipitation levels in the Northeast.

And the Academy of Sciences stated that there has been a decrease in sulfate concentration since 1964, but an increase in nitrate concentration over the same time. The annual pH of precipitation showed no long-term significant change.

And from that particular chapter, they go, then, to say that, although sulfate concentrations decreased over that time period at Hubbard Brook by about 33 percent, they point out that the increase in the nitrate levels ended up canceling out the effects of the decrease in the sulfate concentrations, and the net effect was that the pH of the water stayed the same.

And I have copies of those pages from the NAS study——

Mr. COATS. You mean to say that the lakes and streams are becoming less acidic due to sulfate emission or fallout and more acidic due to nitrogen oxide precipitation or impact?

Mr. LANTZ. According to the chapter that addresses that question in the National Academy of Sciences, that is correct. And I have copies of those pages from the study if the members of the committee would be interested.

Mr. SIKORSKI. OK.

Mr. COATS. Mr. Chairman, I'd ask for unanimous consent that that information be made part of the record.

I'd like to defer to my colleague here from Minnesota.

Mr. SIKORSKI. On that point, Mr. Chairman, what's the National Academy's recommendation with regards to SO_2 and NO_x?

Mr. LANTZ. Their recommendations, as I recall them, were to have more research done on it, stating that there is no way that one can establish a direct link between one source——

Mr. SIKORSKI. No, no, no. Apparently, you're testifying to the fact, using the National Academy of Science as the authority, that there's a growing problem with nitrogen oxide emissions, isn't that what you're saying?

Mr. LANTZ. Well, if I may quote from one of the scientists on that study, Dr. Jack Calbert, head of the panel conducting the NAS study of 1983. He said:

> We cannot judge whether reducing emissions in a specific geographic area would help significantly to alleviate the acid rain problem in another area.

Mr. SIKORSKI. And they go on to say that—

> But we need reductions, we need the 50 percent reductions, and we shouldn't wait, and we should go now.

But you don't mention those things.

But on the issue of nitrogen oxide versus sulfur dioxide, I think we, who receive nitrogen oxide and have snow that melts in a brief period, and spikes the acidic concentration of streams and lakes, and does a tremendous damage in just a short period of time, don't get the benefit of a lot of the debate. That is because nitrogen oxide is captured in the snow to a much greater extent than the sulfur oxides are.

I'm concerned that the record be as clear as possible on nitrogen oxide. We also propose to do something in this record. And I was a little disappointed that the Academy didn't come down stronger on doing something on nitrogen oxide.

So, the fact that you're now talking about their increased concentration in review of nitrogen oxide is borne out in their conclusions because they——

Ms. HUBBARD. It is an assumption that one could make, but I agree with you it's not necessarily borne out. You can assume that from some of the evidence.

What it does—it does come out to say that more research is needed, and it does not endorse a specific acid rain control program.

Mr. SIKORSKI. What they say is that we should do some more research on nitrogen oxide. The study—evidence is growing that nitrogen oxide is more of a problem than it was 2 years ago when they said it wasn't a problem. It was the sulfur oxides that were the problem. Yet, they still think the focus is on control programs, which they encourage, should be a 50-percent reduction, should begin quickly, and should still keep concentrated on sulfur oxides.

Mr. LANTZ. If I may read the NAS' own words, on page 119, they say:

> The contribution of nitric acid to total acidity has been increasing; whereas, that of sulfuric acid has been decreasing.

Mr. SIKORSKI. And they go on to recommend a 50-percent reduction in sulfur oxide emissions in this country.

Mr. COATS. Do you have that recommendation?

Mr. LANTZ. That particular page, I do not; however, what they have stated is in the 31-State area east of the Mississippi, they are saying that lower sulfur dioxide emissions would result in reductions in concentrations of sulfuric acid.

Mr. COATS. Do they recommend a 50-percent reduction?

Mr. LANTZ. I do not recall whether that is a specific recommendation or not.

Mr. COATS. I wonder if the gentleman from Minnesota could supply the committee with a copy of the exact wording in terms of the recommendation there.

Mr. SIKORSKI. I just want to comment. If people have to go to page 119, they can just read the summary of the National Academy of Sciences, or read the papers, or look at the TV articles on it.

The National Academy of Sciences report is, again, this year, as it did 2 years ago, recommends in clear language the type of control program that we're embracing in this bill. And it's a little discomforting to see people come in and cite these authorities, the National Academy of Sciences as an authority, and then somehow have a memory lapse when it comes to the major points that the Academy was talking about.

Ms. HUBBARD. I think our position also rests on studies and so on that we're looking at.

Mr. SIKORSKI. I'll get to you when I have my own time.

I've been leaning on his time.

Mr. WAXMAN. Well, the gentleman is correct. The time does now belong to the gentleman from Indiana, Mr. Coats.

Mr. COATS. Well, what's left of it, I will just wrap up. The gentleman from Minnesota has learned very well how to appropriate someone else's time.

He loaned me $5 so I couldn't jump in too quickly there.

I think the point of the dialog that has just taken place here indicates the dilemma that those of us in Indiana face. We're trying to be responsible environmentalists. We walk in the woods, and we go fishing, and we have kids that enjoy that atmosphere, and we want to breathe clean air as much as anybody else. We want to be responsive to that.

But we also represent constituents who have jobs mining coal, who work in factories that burn coal, our lights and our heat to a disproportionate amount as compared to other states is generated by coal, and we want to be very sensitive to that.

We've come through a difficult recession. We're trying to bring Indiana back, and we're on the way back, but the last thing we need is to devastate our industries with costs, unless we're absolutely sure that this is going to solve the problem.

And we have scientists on both sides saying opposite things. We have reports from reputable people saying opposite things. And we have some people saying that the acidity is getting better, and some say it's getting worse, and some say it's a problem of auto emissions, and some say it's sulfur emissions, and it's probably a little bit of both.

But we've got to have hard facts before we commit this state to spend millions and billions of dollars that's going to have an adverse economic impact.

And the dialog that's just taken place really capsulizes the problem that exists now, and that's why I'm pushing so hard for more research, more money for research. Let's get the facts before we act.

Ms. HUBBARD. We agree.

Mr. COATS. With that, I'll yield back my time.

Thank you, Mr. Chairman.

Mr. WAXMAN. Thank you very much.

I do want to clarify for the record, since we have the ICF, Inc., reference, how they've evaluated the productivity, and I want to read directly from it.

They say:

> By 1995, some of these existing mines will have retired because of exhaustion of reserves. New replacement mines at a given sulfur level would generally have less favorable geological characteristics, either surface mines, which are smaller and/or have prior overburdened ratios, or shifts to deep mines. In each case, the productivity of these replacement mines will tend to be less than that of the older.

And then skipping a part where they go on to illustrate that point, let me complete that sentence:

> In each case, the productivity of these replacement mines will tend to be less than that of the older, low-stripping ratio mines; thus, requiring more workers for a given production level.

And then further, they say:

> Hence, a shift to deep production, as surface reserves are depleted, involves lower productivity and more miners, but without a substantial jump in price.

That is how they've come up with the evaluation—this is not to speak poorly at all of the productivity of the miners in Indiana—but to point out that the geological factors will play a role in their assumptions. That was how they came up with their figures.

Mr. STILWELL. Mr. Chairman, could I respond to that?

Mr. WAXMAN. Yes, sure, Mr. Stilwell.

Mr. STILWELL. I would like to point out to the committee that in the State of Indiana we do have approximately 17 billion tons of recoverable reserves. Most of those are underground reserves, which would result in lower productivity, but I would also like to point out that we have in the neighborhood of 2 billion tons of strippable coal available for immediate recovery under present mining technology methods. And those 2 billion tons is enough to last this State for many, many years at 30 million or even 50 million tons production per year.

So we do have a lot of coal available that we're mining right now under present technology; that I think past history is that coal companies get what's most profitable first and what's most unprofitable last.

Mr. WAXMAN. Well, I think they probably looked at the fact that a lot of the area that can be strip mined would, under the Strip Mining Act, be considered prime agricultural land and, therefore, would be out of bounds for consideration for use of that coal. I think that was part of their assumptions when they looked at the fact that there would be less productivity in deeper mines.

Nevertheless, I wanted to point that out for the record, and we're going to have to evaluate the assumptions. Obviously, going back and forth here, without sitting down and looking at it carefully, is not the most concerted way to evaluate the assumptions.

I think you're all familiar with ICF, a very reputable organization, that has been hired by the Department of Energy, Environmental Protection Agency, and by the utilities themselves. They are a disinterested party, and I think we need to evaluate their assumptions and evaluate their work. They weren't trying to present a brief on behalf of H.R. 3400. They were giving their evaluation. And this particular study that I'm citing was done for the coal industry, so we want to look at that.

And in response to Mr. Coats, I read this section, and we have reports that are available to us, so that we can look at them and evaluate them. And when we hear conflict as to what the reports say, some of that conflict, I think, can be resolved.

Either the National Academy of Science recommends a 50-percent reduction or it doesn't, and we'll be able to look at that and determine it. And we have to evaluate, as well, whether we think that's what course we ought to take, that, given all the other political circumstances.

So, I share your frustration. Some of it, I think, can be alleviated by sitting down and reading these assumptions, evaluating them together, and seeing whether they make a lot of sense. And then if they hold up, then we know whether or not we can rely on the conclusions they give us.

Of course, that's got to be the basis for how we reach conclusions; not whether we emotionally want to deal with the problem or not. We have to determine how can we deal with the information in a way that will lead us to value the acid rain problem, while still holding the jobs here in Indiana.

Mr. Sikorski, you've taken up a lot of time from Mr. Coats, but you haven't been recognized on your own time. I'd be pleased to recognize you for a brief minute or two.

Mr. SIKORSKI. No way.

Mr. WAXMAN. A gentleman who asserts his rights, I'll have to recognize him for five minutes.

Mr. SIKORSKI. To offer the gentleman from Indiana some solace, first of all, the White House Office of Science and Technology says there is no complete, absolute knowledge; we shouldn't seek assurance on anything more on acid rain until the year 2000, because it's not going to be coming.

And, second, there have been up to 6,000 analysis studies, and reports done, and the scientists are way ahead of us. Even the Hudson Institute doesn't bring in scientists. It brings researchers in who try to pinpoint methodology. The scientists are way ahead of us.

I'm reminded of one article I saw a few years ago, that one of the utilities groups funded an acid rain study some place in Pennsylvania. They came up with the conclusion that duck hunters were the cause of acid rain. I'll show it to you. It's in the record. In fact, duck hunters were the cause of acid rain because they were shooting more ducks than before, and the ducks aren't swimming, and, therefore, using the lakes for bathroom purposes, which would neutralize the acid rain.

And this is the type of thing we have.

And every time we come and we have this type of exchange, don't confuse this type of exchange for confusion within the scientific community about what's the problem here. The problem is clear.

And I have to ask Ms. Hubbard: You raised two basic points in your testimony. First, you recite some strange conclusion of the National Academy of Science as supportive of no action, wait, don't know, which are your positions. Somehow you're citing them in support, but you admit their conclusion that the only way to control acid rain is to reduce SO_x and NO_x, and you can find those in the September 1981 report —and I have a copy of it here—amelioration, page 181, and it's already in the record, but we could put it in again, if there isn't an objection.

Also, you don't cite the statement in the June 1983 report:

> If ambient concentrations of NO_x, nonmethane hydrocarbons, a basic substance such as ammonium calcium carbonate, remain unchanged, a reduction in sulfate deposition result in, at least, as great as a reduction in the deposition of hydrogen.

And, finally, on page 3 of its 1980 report, since you talk about your concern as economics:

> The committee believes that continued emission of sulfur nitrogen oxides at current or accelerated rates in the face of clear evidence of serious hazard to human health and to the biosphere—

Contradicting Mr. Maguire's comment—

> Will be extremely risky from a long-term economic standpoint, as well as from the standpoint of biosphere protection.

Do you have any studies that contradict what the National Academy of Science has recommended? They're an independent group. They're our best minds in the country. They have no quarrel with industry, or utilities, or environmentalists, or anyone else. Do you have any analysis that says they're wrong?

Ms. HUBBARD. I don't have any that I can refer to right offhand that says that they're wrong. They're, obviously, highly regarded and so on, and they're just 1 of the 6,000 studies that have been done on the issue.

The basic problem that we have with this bill, and with an acid rain control program is that this focuses much on Midwest emissions, where it doesn't give any significance to the impact of local source emissions, which—

Mr. SIKORSKI. I don't know if the coal industry would get any solace out of that comment——

Ms. HUBBARD [continuing]. Is a pretty important point, and I would like to know why you all——

Mr. SIKORSKI [continuing]. Since if it's coal being burned in the local nonutility source is still going to affect them.

But I take it coal companies are members of your organization, are they not?

Ms. HUBBARD. There are some.

Mr. SIKORSKI. Let me use that to comment on Mr. Maguire's point that somehow this bill's unfair; that 21 States have to bear the burden, and the other States go scot-free.

I come from one of the States that makes the argument that my bill's unfair to my people, because we make them reduce.

And if you will look, emission reductions in that 3 million, which are focusing on—the rest is highly subsidized—the 3 million that you say is unfair is based on those States' contribution to total national emissions. I don't know what could be more equitable or more fair than you have to reduce your emissions proportionately.

And I can make an argument that it is unfair to the low State emissions that you were talking about, because those States, to a great extent, have low emissions for a lot of reasons, but in Minnesota and several other States, the low emissions are there because we've put in the scrubbers, we've put in the clean-up. And to halve our emissions is much more expensive than for you to halve your emissions. In Wisconsin, it's the same way— not a scrubber in the entire state—but for them to halve their emissions is much cheaper for them than for us in Minnesota. I want to know——

Mr. MAGUIRE. If I could respond to that?

Mr. SIKORSKI. Yes.

Mr. MAGUIRE. I think the basic difference we have is that if we look to the acid rain problem in itself, and that is the problem that they have in the sensitive areas of the Northeastern part of the United States and in Canada, how do we reduce the acidity to those areas?

And what we're saying is your bill does not do that.

By taking the top 50 emitters randomly, you do not go to one of the conclusions that the National Academy pointed out, and that is the farther a source is from the receptor site, the less impact a reduction is going to have.

Mr. SIKORSKI. Can you cite the page or provide it for the record? That's not a fair analysis of what the National Academy of Science has said on that point, but I think— I'd like to refer to what we're doing in Indiana, and New York, for example, and we should also have the dollars attached to those reductions, and you can see what happens with utility rates in those States, as well. No one's being treated unfairly; at least, we don't want to, and if you can show that we are, then we'll try to make adjustments.

Mr. MAGUIRE. I can provide you that. I can get you that.

Also, one thing that you put into the record there, I want to emphasize, and that is what the National Academy has said about all those other factors remaining unchanged if you have a reduction in SO_2 emissions, you will have some reduction in acid deposition, and I think you need to look at that very carefully.

All those other factors that you pointed out, the ozone, the hydrocarbons, nitrogen oxide——

[The following information was submitted for the record:]

10

IMPLICATIONS FOR EMISSION-CONTROL STRATEGIES

The implications of our findings and conclusions for choosing among possible emission-control strategies, should they be deemed necessary, are limited. We do not believe it is practical at this time to rely upon currently available models to distinguish among alternative strategies. In the absence of other methods, analysis of observational data provides guidance for assessing the consequences of changing SO_2 emissions for wet deposition of sulfate.

If we assume that all other factors, including meteorology, remain unchanged, the annual average concentration of sulfate in precipitation at a given site should be reduced in proportion to a reduction in SO_2 and sulfate transported to that site from a source or region of sources. If ambient concentrations of NO_x, nonmethane hydrocarbons, and basic substances (such as ammonia and calcium carbonate) remain unchanged, a reduction in sulfate deposition will result in at least as great a reduction in the deposition of hydrogen ion.

It can be stated as a rule of thumb that the farther a source is from a given receptor site, the smaller its influence on that site will be per unit mass emitted. Analysis of air-mass trajectories and modeling may provide insight into the relative contributions of subregional groupings of sources to sulfate deposition in ecologically sensitive areas. Interpretation of this information, however, is subjective, and it will entail considerable judgment in assigning zones of influence of sources, even for long-term averages. This subjectivity has been a source of major differences in expert opinion, and it will continue to be until scientific knowledge improves considerably.

On the basis of analysis of the spatial distributions of the molar ratios of pollutants in emissions and deposition and assuming that all other emissions and conditions remain unchanged, we would expect that if the molar ratio in emissions in eastern North America were changed by changing SO_2 emissions, a similar change would occur in the ratio of sulfate to nitrate in wet deposition. If, as described in Chapter 4, dry deposition is linearly proportional to emissions, then the average annual ratio in total deposition in the region should also respond to changes in the emission ratio. Because the analysis is based on spatial distributions, its applicability is limited to circumstances in which the spatial distribution of emissions is not changed. Because we cannot rely on current models or analyses of air-mass trajectories, we cannot objectively predict the consequences for deposition in ecologically sensitive areas of changing the spatial pattern of emissions in eastern North America, such as by reducing emissions in one area by a larger percentage than in other areas.

RESEARCH NEEDS

We believe that extensive laboratory, field, and modeling studies should be continued if we are to establish the physical and chemical mechanisms governing acid deposition (see Chapter 5). It appears to us, however, that useful information about the delivery of acids to ecologically sensitive areas by transport and transformation processes can be determined more quickly by direct empirical observation in the field than by other means. Although the results of such field studies may not yield complete detailed descriptions of the interactions of all the processes involved, the studies are likely to provide basic phenomenological evidence with sufficient reliability to form a basis for improving the near-term strategy for dealing with the problem of acid deposition in eastern North America. Indeed, the data are essential to enhance theoretical understanding and to develop improved deposition models. In the long term, however, the ultimate strategy for dealing with acid deposition will depend on the application of realistic, validated models.

Mr. SIKORSKI. You want us to tighten it?

Mr. MAGUIRE. No, but are you really trying to solve the acid rain problem in those areas that are having problems?

Mr. SIKORSKI. Well, do you support the Clean Air Act as it currently exists?

Mr. MAGUIRE. Yes.

Mr. SIKORSKI. Do you, Ms. Hubbard, support the Clean Air Act as it exists?

Ms. HUBBARD. Yes.

Mr. SIKORSKI. You focus on economics, and just as the Department of Health does on the health aspects of acid rain, I'm wondering if you've looked at the economic cost of acid rain in Indiana.

Ms. HUBBARD. We looked at the cost of electricity increases for various bills and——

Mr. SIKORSKI. No; I mean the cost of acid rain to the economy of Indiana.

Ms. HUBBARD. In terms of the—you mean some of the claims of damage to forests and to that kind of thing?

Mr. SIKORSKI. Forests.

Ms. HUBBARD. We have investigated some.

Mr. SIKORSKI. Tourism, sport fishing——

Ms. HUBBARD. Right.

Mr. SIKORSKI [continuing]. Agriculture.

Ms. HUBBARD. In fact, we have Orie Louck's study in our offices.

Mr. SIKORSKI. Couldn't that be provided to us?

Ms. HUBBARD. Sure. I thought it was earlier.

Mr. SIKORSKI. Have you looked at the cost to your members of increased insurance premiums due to the effects of acid rain?

Ms. HUBBARD. No; we have not.

Mr. SIKORSKI. Or any of the health costs associated with SO_2 emissions, NO_x emissions?

Ms. HUBBARD. No, we have not. We've not been convinced entirely that there are serious health problems related to SO_2 emissions.

Mr. SIKORSKI. Have you looked at——

Mr. MAGUIRE. That $5 billion figure's been thrown out, and I've never seen what—you know, just what is behind that figure.

Mr. SIKORSKI. That's the National Academy of Sciences 1981 report.

Mr. MAGUIRE. Well, what do they base that on?

Mr. SIKORSKI. Have you looked at, Ms. Hubbard, the effect of the $2 billion that you get under H.R. 3400 to the economy to the State of Indiana?

Ms. HUBBARD. The $2 billion what?

Mr. SIKORSKI. The $2 billion that H.R. 3400 brings into the State of Indiana from outside the State of Indiana from other rate payers.

Ms. HUBBARD. You mean for the one mill tax?

Mr. SIKORSKI. Yes.

Ms. HUBBARD. But I'm not—we're more concerned with the basic acid rain problem.

I want to end with one thing——

Mr. SIKORSKI. Would you answer my question? Have you looked at that?

Ms. HUBBARD. No. One thing I'd just like to throw out——

Mr. SIKORSKI. Have you looked at new jobs associated with scrubbers to the economy?

Ms. HUBBARD. Yes; we've looked at that.

Mr. SIKORSKI. And what's your conclusion?

Ms. HUBBARD. Well, obviously, it's great to have new jobs, but we don't feel the control program is going to solve the problem, so we're not supporting it.

Mr. SIKORSKI. How many jobs are associated with those scrubbers?

Ms. HUBBARD. Well, as you can see here today, there are a lot of differing opinions on how many different jobs are associated with the scrubbers, so I mean——

Mr. SIKORSKI. Mr. Chairman, I'm going to end.

I just—I thought I just heard you tell me you looked at that fact.

Ms. HUBBARD. Well, yes, I've read some of the information that some of the companies have put out on jobs. I cannot refer to what they are at this time.

Mr. SIKORSKI. In Indiana?

Ms. HUBBARD. Yes; I have, in Indiana, but I cannot——

Mr. SIKORSKI. Would you be willing to provide that data to the Committee? I've not seen that, and I'd be interested in seeing that.

Ms. HUBBARD. Yes, I think we have it, don't we? We'll look.

Mr. WAXMAN. Thank you, Mr. Sikorski.

You started to say something, and I don't want you to be interrupted.

Ms. HUBBARD. I wanted to add one thing. This was new information to me this morning, and maybe it's something you all already know, that apparently the National Acid Deposition Assessment Program met in Maryland last week. I guess it's a group of 163 scientists and government agency representatives, and so on.

Their conclusions—their consensus, rather, is that; one, acidity in rainfall has neither increased, nor decreased; that acidity in lakes, especially in the Northeast, has increased; in fact, it's become—has not increased, and, in fact, has become more alkaline; that no major effects on crops are seen at this time, and forest damage is unknown; that the extent of damage to lakes is smaller than originally thought; and the consensus is there is no need for quick acid rain control legislation at this time.

I don't know. This information was new to me, as well.

Mr. COATS. Mr. Chairman, I would ask unanimous consent that this additional information also be added to the record.

Mr. WAXMAN. Let me respond by asking unanimous consent, since throughout this discussion all sorts of data and reports were requested, that rather than everything included in the record automatically, it be done at the discretion of the chairman, so we don't have a transcript that runs into too many volumes.

And without objection, that will be the order, and we will be pleased to get that additional information from you.

Mr. COATS. Mr. Chairman.

Mr. WAXMAN. Yes.

Mr. COATS. Can we ensure that the minority side has some input as to what does or doesn't go in the record?

Mr. **Waxman**. I think that's a reasonable request. We have had a good exchange, and I think we're all going to go back and read these reports again.

Mr. **Coats**. All 6,000?

Mr. **Waxman**. And I think that's appropriate.

Mr. **Coats**. I want to read the best report.

Mr. **Waxman**. We need to be on the same wave length if we're going to accomplish the objectives that we say we all want to achieve. Let's see if we can do that.

And I very much appreciate you being here, and I want to thank you for your participation.

We would like to now call forward three witnesses who will testify together in a panel: Sy Ali, executive director for environmental affairs, Public Service Indiana; Robert McKnight, chief environmental engineer, Indianapolis Power & Light; and Dale Winters, Hoosier Energy Rural Electric Cooperative.

I'm pleased to call on you first to present your testimony. Your prepared statement will be made a part of the record in full. I notice you have a slide presentation for us. We're pleased to receive it. And we'd like to ask you, and the other panelists, to try to stay within 5 minutes in your presentation to us.

Mr. Sy Ali.

STATEMENTS OF SY A. ALI, EXECUTIVE DIRECTOR, ENVIRONMENTAL PROGRAMS, PUBLIC SERVICE OF INDIANA; DALE D. WINTER, ON BEHALF OF INDIANA STATEWIDE ASSOCIATION OF RURAL ELECTRIC COOPERATIVES; AND ROBERT A. KcKNIGHT, CHIEF ENVIRONMENTAL ENGINEER, INDIANAPOLIS POWER & LIGHT CO.

Mr. **Ali**. Thank you very much for this opportunity.

Mr. Chairman, distinguished members of the panel, ladies and gentlemen, my name is Sy Ali.

I am presenting this testimony on behalf of Public Service Co. of Indiana, Inc. [PSI]. I am employed by PSI as executive director, environmental programs.

We appreciate the decision by the Subcommittee on Health and the Environment, and its distinguished chairman, the Honorable Henry Waxman, to hold field hearings. This provides a splendid opportunity to gain a firsthand perspective on the issues surrounding H.R. 3400.

In our view, H.R. 3400 shares two characteristics with all pending House and Senate bills which call for emission control. First, these bills cannot guarantee to solve the acid rain problem. Second, they are guaranteed to impose devastating costs on the already beleaguered Midwest.

We believe H.R. 3400 is a bad bill for Indiana, and for our customers. There are three major deficiencies in this bill.

Only powerplants, predominantly in the Midwest, and some new trucks are controlled, even though the bill is described as a national bill. The powerplant selection process appears highly arbitrary, making intended ecological improvements very costly. Anticipated revenues from the electric energy fee would be inadequate to meet capital costs of controls. Indiana would likely be short changed, because the bill promotes reimbursement on a first-come, first-paid basis.

The compliance schedule is exceedingly ambitious and realistically unachievable.

As you can see on this first slide, most of the targeted 50 powerplants are clustered in the Midwest. Yet, the bill is described as one which would reduce emissions in the 48 contiguous States. Shouldn't a national bill target all sources in all States?

Even among powerplants, the bill arbitrarily requires controls on only those which, in 1980, had a sulfur oxide [SO_2] emission rate equal to or in excess of 3 pounds per million Btu, regardless of the total tons of pollutant emitted. There appears to be no good scientific or economic basis for such requirement. The bill provides no provision for age or likely retirement date of the plants, retrofit capabilities, or potential cost effectiveness through emission reduction mechanism. H.R. 3400 appears to penalize utilities which constructed large powerplants, utilizing economy of scale.

The next slide contains SO_2 and NO_x emission density by State prepared by the Office of Technology Assessment [OTA]. The OTA data in this chart is arranged in descending order on this slide, and then SO_2 reduction density for each State required by H.R. 3400, is added. The inherent bias of this bill against the Midwest is apparent when we glance at the solid—dark—bars, which represent reduction density. For example, Massachusetts and New Jersey, both having higher emission density than Indiana, are allocated considerably lower reduction density than Indiana. Indiana's emission reduction is 76 percent. As you will see, Minnesota is fairly low. It is not contributing as much as some of the other Midwestern States.

United States-Canadian memoradum of intent dispersion models and the U.S. EPA cost models were used to develop a matrix, which allows one to generate a cost-effective strategy for SO_2 reduction.

This third slide was prepared by ICF and SAI, both of whom have been identified as credible groups to do such work.

The next slide shows a series of graphs, each representing a group of States in increments of 200 miles from an ecologically sensitive area. The graphs indicate that using a local coal option a cost-effective SO_2 emission reduction plan should; one, minimize reductions in Indiana; and, two, Canadian sources must also be controlled if equitable emission reductions are to be achieved.

H.R. 3400 provides inadequate coverage of the required capital costs. OTA analysis states that the fee may have to be "extended for several more years" beyond the cutoff date in the bill, just to pay the 90-percent capital costs of the top 50 plants. According to Congressional Research Service [CRS], the revenues generated by a proposed legislation similar to H.R. 3400, will not meet the capital requirements.

The formula for partial reimbursement of the capital costs is unfavorable to Indiana. Utilities in States, such as Indiana, which do not have construction work in progress [CWIP] may qualify too late for reimbursement.

The next slide presents our estimate of the capital and annualized costs, and the impact of H.R. 3400 on our customers. It would require $1.1 billion in 1983 dollars to comply with 79.3-percent emission reduction from our powerplants. The estimate rate impact on our customers would be 47.9 percent, compared to the OTA estimated average rate impact in Indiana of 14 percent. Based on the company's extremely unfavorable financial situation, it is unlikely that we could even finance any capital costs.

The bill requires that the 50 designated plants must have scrubbers installed and operational within 2 years after a contract to purchase. A more realistic schedule would be 5 years. When retrofitting existing powerplants with emission controls, it is important to evaluate all the site specific constraints.

The next slide focuses on such constraints. Our Gibson plant shown here would face serious physical limitations. It may require erecting costly superstructures to accommodate four additional scrubbers in order to comply with H.R. 3400.

Since 1975, Midwestern utilities and the Tennessee Valley Authority [TVA] have reduced SO_2 emissions by about 20 percent or by 2½ million tons. This significant reduction, however, has not resulted in any measurable change in the acidity of rain in the Eastern United States.

The next slide shows that the SO_2 emission reduction trend started by Midwestern utilities will continue through the rest of the century. The projected emissions by the year 2000 will be another 1 million tons lower than the current level.

What is even more important is that the projected coal consumption, during the same period, will increase by 41 million tons or about 25 percent. This, indeed, would be an impressive accomplishment by the Midwest.

Instead of embarking on a "controls now" program, which would cost $100 billion, the U.S. Congress and the Federal Government should promote such investments in the development of clean combustion technology. Additionally, the private sector should be encouraged to accelerate commercialization of this efficient, clean technology. Included in this category are fluidized bed combustion, coal gasification, and limestone injection multistage burner.

This slide contains a fascinating message for this subcommittee. The graphs were prepared by the EPA and express different scenarios of emission reductions. The "retrofit acid rain" scenario calls for somewhat similar reduction as H.R. 3400. The "new technology" or the clean combustion technology development scenario would result in vastly lower emissions and obtained through acid rain control. With the acceleration of this technology through adequate funding, emission reductions could be achieved consistent with the "acid rain" scenario schedules.

My recommendations on the issue of acid rain, and for any proposed legislation requiring controls, such as H.R. 3400, are submitted on this last side.

Specifically, I urge this subcommittee for its favorable action to: Accelerate national acid rain research programs through increased funding, and by enhancing current schedules of the National Acid Precipitation Assessment Program and the Acid Precipitation Act of 1980; support mitigation strategies, such as liming certain acidic lakes; promote clean combustion technologies as a national goal.

I thank you for giving me this opportunity.

[Testimony resumes on p. 601.]

[Mr. Ali's prepared statement follows:]

STATEMENT OF SY A. ALI

Mr. Chairman, distinguished members of the panel, ladies and gentlemen. My name is Sy A. Ali. I am presenting this testimony on behalf of Public Service Company of Indiana, Inc., (PSI). I am employed by PSI as Executive Director, Environmental Programs.

We appreciate the decision by the Subcommittee on Health & the Environment and its distinguished Chairman, the Honorable Henry Waxman, to hold field hearings. This provides a splendid opportunity to gain a first hand perspective on the issues surrounding H.R. 3400. As you know, H.R. 3400 was introduced by Chairman Waxman, Mr. Sikorski (MN) and Mr. Gregg (NH) in the first session of the 98th Congress. It is intended to amend the Clean Air Act to control certain sources of sulfur dioxide (SO2) and nitrogen oxides (NOx). These controls, it is hoped, will reduce acid deposition.

In our view, H.R. 3400 shares two characteristics with all pending House and Senate Bills which call for emission control. First, these bills cannot guarantee to solve the acid rain problem. Second they are guaranteed to impose devastating costs on the already beleaguered Midwest.

H.R. 3400 - A Bad Bill for Indiana

We believe that H.R. 3400 is a bad bill for Indiana, and for our customers. The bill's most glaring flaw is the way it targets the Midwest to remedy a perceived ecological problem in the Northeast. The bill prescribes an arbitrary and we believe, ineffective approach to decrease sulfur dioxide, purportedly a precursor of acid deposition in affected states. The bill is described as one which would reduce emissions in the 48 contiguous states.

Yet almost all of the intended reduction, as shown in Exhibits 1 and 2, comes primarily from a few Midwestern states. Shouldn't a national bill target all sources in all states? The bill addresses only power plants to control SO2/NOx and certain new trucks to control NOx, and ignores all other emission sources - industrial, commercial, automobiles.

The language of the bill selectively identifies power plants as the only SO2 emitting source which must be controlled, (Section 185). Does this mean that SO2/NOx from a non power plant source is acceptable? Even among power plants, the bill arbitrarily requires controls on only those power plants which in 1980 had an SO2 emission rate equal to or in excess of 3 pounds per million BTU, regardless of the total quantity of pollutant emitted. There appears to be no good scientific and economic basis for targeting the 50 identified power plants, nor the emission rate. Our Wabash River Station for example, emitted less SO2 in 1980, the base year, than 28 other plants which are excluded. But because its rate exceeded an arbitrary ceiling, Wabash River is on the H.R. 3400 list. The bill provides no consideration for age or likely retirement date of the plants, retrofit capabilities, or potential cost effectiveness through other emission reduction mechanisms. Furthermore, it penalizes utility systems which utilized economy of scale and constructed large power plants.

Sulfur oxides and oxides of nitrogen are as high in some of the eastern states as in Indiana. Emission density is a measure which specifies the amount of pollutant per unit area. This index is the basis for our air quality standards. The emission density data by states, prepared by the Office of Technology Assessment (OTA) is given in Exhibit 3. Presented in

EXHIBIT 1

HIGHEST SULFUR DIOXIDE EMITTING UTILITY PLANTS

With SO_2 Emission Rates Greater Than or Equal to 3 lbs./MM Btu

1980 SO_2 Rank	Plant Name	State	SO_2 Emissions (1000 tons)	SO_2 Emission Rate (lbs./MM Btu)
1	Gavin	Ohio	376.4	5.1
2	Cumberland	Tennessee	356.8	6.5
3	Paradise	Kentucky	342.7	6.8
4	Gibson Station	Indiana	305.6	4.9
5	Clifty Creek	Indiana	288.2	6.4
6	Baldwin	Illinois	259.3	6.2
7	Muskingum	Ohio	244.0	7.7
8	Labadie	Missouri	237.2	4.2
9	Harrison	West Virginia	215.0	4.0
10	Wansley	Georgia	209.8	3.7
11	Kincaid	Illinois	205.5	6.5
12	Conemaugh	Pennsylvania	205.2	3.8
13	Kyger Creek	Ohio	202.3	6.2
14	Conesville	Ohio	200.8	5.2
15	Madrid	Missouri	198.9	5.6
16	Mitchell	West Virginia	171.3	4.0
17	Hatfield	Pennsylvania	171.2	4.1
18	Homer City	Pennsylvania	169.1	3.2
19	Montrose	Missouri	162.0	11.7
20	Eastlake	Ohio	155.0	4.9
21	Big Bend	Florida	153.2	4.6
22	Kammer	West Virginia	149.1	6.7
23	Brunner Island	Pennsylvania	139.0	3.0
24	Coffeen	Illinois	137.3	6.9
25	Gallatin	Tennessee	137.1	4.5
26	Johnsonville	Tennessee	135.3	3.7
27	Colbert	Alabama	125.9	3.7
28	Hill	Missouri	121.6	8.5
29	Cayuga	Indiana	115.9	4.1
30	Yates	Georgia	106.6	3.1
31	Joppa	Illinois	100.1	3.3
32	Sioux	Missouri	97.2	4.5
33	Ft. Martin	West Virginia	95.1	3.0
34	Tanners Creek	Indiana	94.9	4.2
35	Mill Creek	Kentucky	94.1	4.1
36	Avon Lake	Ohio	89.5	4.1
37	Ghent	Kentucky	85.4	3.3
38	Burger	Ohio	84.7	6.1
39	Savier	Tennessee	81.4	3.2
40	Crist	Florida	76.3	3.6
41	B. Oak Creek	Wisconsin	75.7	4.7
42	Michigan City	Indiana	75.4	4.7
43	Allen	Tennessee	73.9	3.7
44	Crystal River	Florida	72.6	3.1
45	Breed	Indiana	71.0	6.6
46	Ashtabula	Ohio	68.5	5.6
47	Coleman	Kentucky	68.3	4.0
48	Wabash River	Indiana	66.0	3.9
49	Watson	Mississippi	65.9	3.6
50	Campbell	Michigan	65.5	3.1

Source: E. H. Pechan and Associates, July 1982, "Estimates of Sulfur Oxide Emissions from the Electric Utility Industry." Report prepared for EPA. As reported in OTA Staff Memorandum dated July 12, 1983.

EXHIBIT 2

"TOP FIFTY" UTILITY PLANTS

H.R. 3400

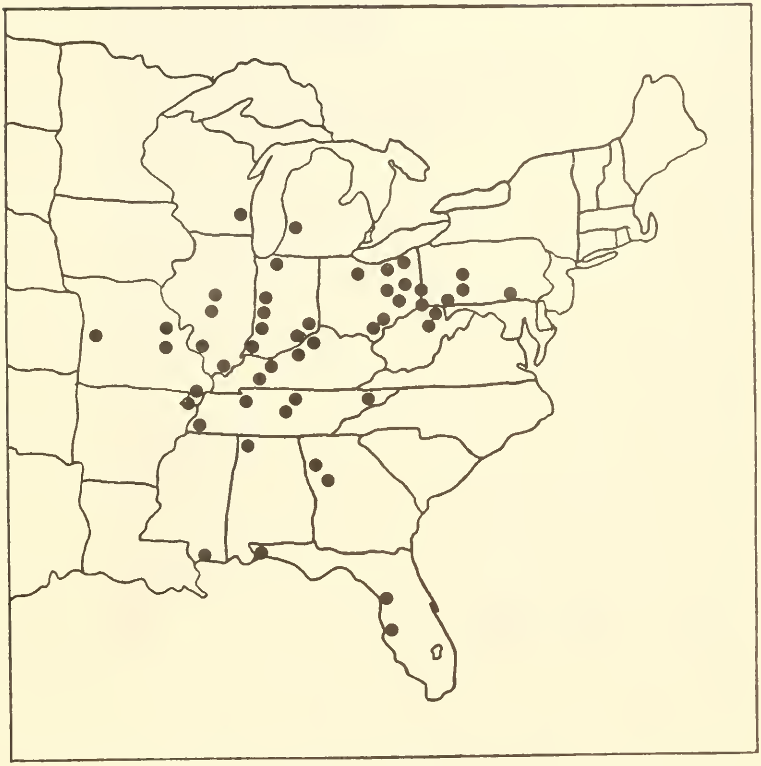
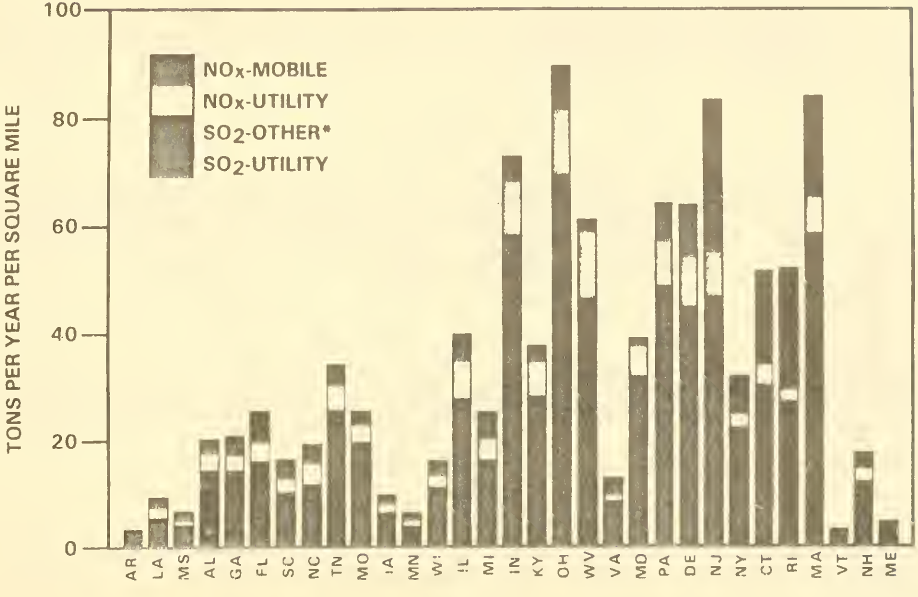


EXHIBIT 3

1980 SO_2 AND NO_x EMISSION DENSITY IN THE EASTERN STATES (All states east of the Mississippi River plus AR, IA, LA, MN, and MO)



Source: OTA

*Residential, commercial, industrial process, refinery, smelter, incinerator, etc.

Exhibit 4 is the Exhibit 3 OTA emission density in descending order, and SO2 reduction density called for by H.R. 3400 in each state. The inherent bias of this bill against the Midwest can be clearly seen as we examine Exhibit 4. Several northeastern states have emission densities comparable to or higher than the Midwest. Yet the H.R. 3400 mandated reductions are considerably less in those states than in the Midwest.

The reduction scheme contained in H.R. 3400 ignores current and rapidly developing scientific knowledge of long range transport and local source contribution. The proposed reductions may result in only modest progress toward desired improvement, because the reductions would occur far away from problem areas. This grandiose, expensive experiment would require 76% emission reduction in Indiana.

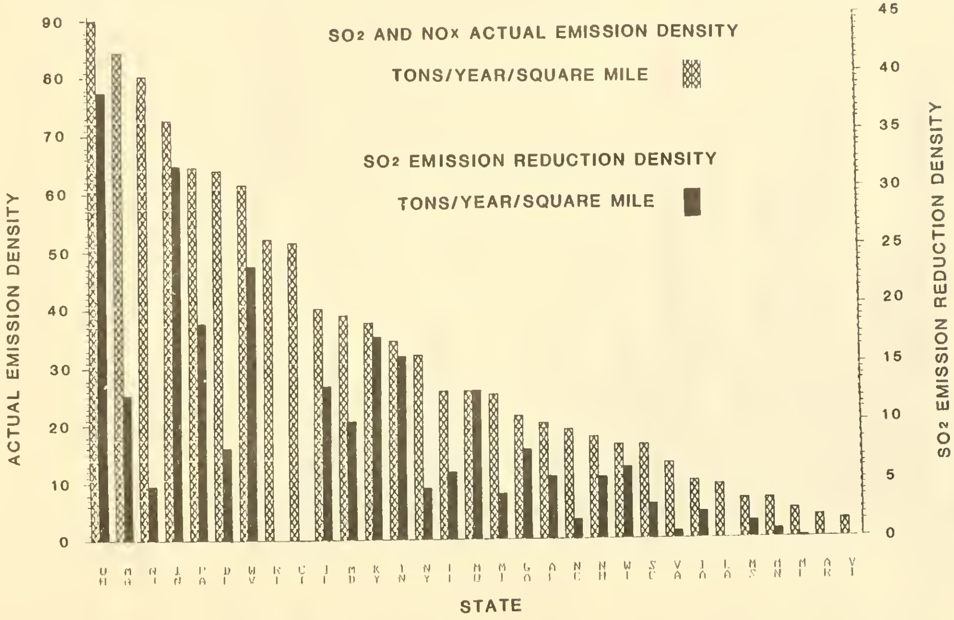
A cost effective alternate strategy to achieve improvement in acid rain precursors could be structured from the data presented in Exhibits 5 and 6. These exhibits are from a document which utilizes the U.S./Canadian Memorandum of Intent (MOI) working group dispersion models and U.S. Environmental Protection Agency (EPA) developed cost model. Using these models, the document generates cost effective control options. The dominating contribution of near sources and the predicted improvement is depicted in these exhibits. Also clearly illustrated is the massive impact of Canadian sources on the Northeastern ecosystem. Canadian sources must be controlled if equitable emission reductions are to be achieved.

Another gross defect of H.R. 3400 is the inadequate coverage of the required capital costs. Congressional Research Service (CRS) has conducted

EXHIBIT 4

(7)

1980 SO2 AND NOX EMISSION DENSITY
AND
SO2 REDUCTION DENSITY IN THE EASTERN U.S.



SOURCE: OFFICE OF TECHNOLOGY ASSESSMENT

PUBLIC SERVICE INDIANA
FEBRUARY 1984 RAM

EXHIBIT 5

FIGURE S-9.

COST EFFECTIVENESS OF SULFATE REDUCTIONS AS A FUNCTION OF DISTANCE FROM ADIRONDACKS RECEPTOR

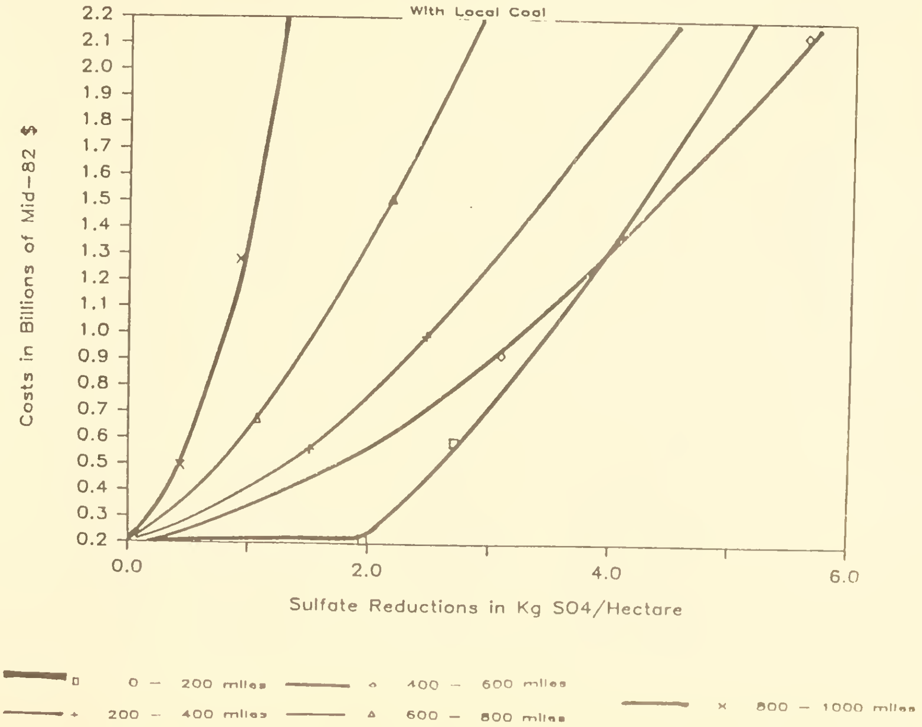


EXHIBIT 6

SIGNIFICANCE OF CANADIAN SO_2 EMISSION REDUCTIONS

	U. S. Utility Reductions ONLY	U. S. Utility and 50% Canadian Reductions
Target Reduction in Acid Deposition in the Adirondacks (Kg. SO_4/Ha)	13.1	13.1
U. S. Utility SO_2 Reductions (10^6 tons)	7.7	5.2
U. S. Utility Cost Increase (mid-1982 $)	$2.8 Billion	$1.5 Billion

SOURCE:
SAI/ICF, STUDY OF ACID DEPOSITION REDUCTION COSTS, 8/83

SCS 2/84

an evaluation of the revenues generated by the proposed electric energy fee. The CRS analysis is presented in Exhibit 7. According to CRS, the revenues from a bill with emission reduction and fees similar to the H.R. 3400 will not meet the capital requirements. In the OTA analysis it is stated that the H.R. 3400 fee would have to be 'extended for several more years' just to pay the 90% capital costs of the top 50 plants. Additional capital costs for the designated plants, capital costs for emission reductions from other sources (Section 191), and all the operating and maintenance costs must be borne by the electric utility customers. An estimate of actual funding requirements for H.R. 3400 is given in Exhibit 8. This exhibit represents the Edison Electric Institute (EEI) sponsored analysis of H.R. 3400 funding by Temple Barker and Sloane, Inc., (TBS). This clearly highlights the shortfall between actual expenditures and revenues available through emission fees. A more equitable method to generate adequate revenues would be a BTU tax on all raw fossil fuels - oil, coal, natural gas. All these fuels generate SO2 and NOx from combustion.

The formula for partial reimbursement of the capital costs (Section 186) is also unfavorable for Indiana. It promotes payments on a 'first come first-paid' basis. The majority of the states have Construction Work in Progress (CWIP) as an approved procedure, and these will qualify their utilities to obtain reimbursement as various phases of construction are completed. But, utilities in states such as Indiana, which do not have CWIP, may qualify too late for reimbursement.

In Exhibit 9, we have presented our estimate of the capital and annualized costs and the impact of H.R. 3400 on our customers. Based on the

EXHIBIT 7

DISTRIBUTING ACID RAIN MITIGATION COSTS

CONGRESSIONAL RESEARCH SERVICE

TABLE A-8
(48-State, 1 mill option)
Program Balance Sheet of Ten-Year
Ten Million Ton Reduction Using Current
Technology Only
(billions of current dollars unless otherwise noted)

Date	Estimated Kwh Generated* (trillions)	Revenues From Fees	Interest on Balance	Expenditures	Cumulative Balance
1984	2.36	2.36	--		2.36
1985	2.43	2.43	.28		5.07
1986	2.50	2.50	.61		8.18
1987	2.58	2.58	.98		11.74
1988	2.65	2.65	1.41		15.80
1989	2.73	2.73	1.90		20.43
1990	2.82	2.82	1.50	7.90	16.35
1991	2.90	2.90	0	17.07	2.68
1992	2.99	2.99	-2.05	18.44	-14.82
1993	3.08	3.08	-4.08	16.60	-32.42
1994	3.17	3.17	-4.21		-33.46
1995	3.26	3.26	-4.35		-34.55
1996	3.36	3.36	-4.49		-35.68**

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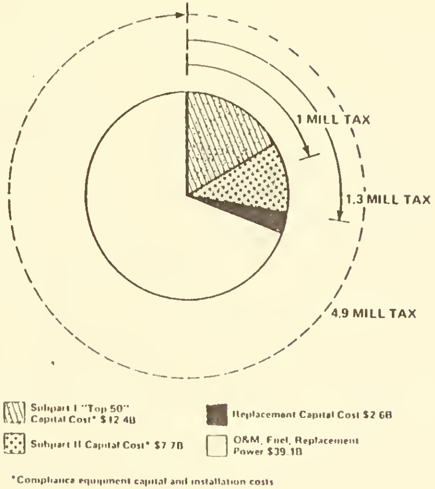
* From all plants in 48-State region. Initial estimates derived from Edison Electric Institute Data. Number includes net imports.

**Interest payments are greater than revenues collected from user fee. Hence, the fee can never pay off the debt.

CRS 4/83

EXHIBIT 8

FUNDING REQUIREMENTS OF H. R. 3400



THE PROPOSED 1 MILL PER KILOWATT-HOUR TAX ON GENERATION WOULD BE INSUFFICIENT TO COVER THE 90 PERCENT OF CAPITAL COSTS THAT WOULD BE ELIGIBLE FOR FUNDING. IF THE TAX WERE COLLECTED FOR 11 YEARS, 1985-1995:

- A 1 MILL TAX WOULD COVER 80 PERCENT OF COMPLIANCE CAPITAL COSTS.
- A 1.3 MILL TAX WOULD COVER ALL COMPLIANCE CAPITAL COSTS.
- A 4.9 MILL TAX WOULD BE NEEDED TO COVER ALL COMPLIANCE COSTS, INCLUDING O&M AND FUEL COSTS.[1]

EVEN IN STATES THAT WOULD RECEIVE THE MOST FROM THE FUND:

- COMPLIANCE COSTS PER HOUSEHOLD WOULD BE REDUCED BY ONLY 25 PERCENT.
- STATES BENEFITTING THE MOST FROM THE FUND WOULD STILL PAY HIGHER NET COSTS THAN OTHER STATES.

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[1] Assuming the Fund would earn interest at 8 percent per year.

SOURCE: EVALUATION OF H. R. 3400 BY TBS FOR EEI DATED 9/20/83

EXHIBIT 9

IMPACT OF H. R. 3400 ON PUBLIC SERVICE INDIANA WITH NO CAPITAL REIMBURSEMENT

(1983 DOLLARS)

Total Capital Costs	$1.1 Billion
First Year (1990) Revenue Requirement	$387.4 Million
Rate Impact	47.9%
(OTA: Indiana Average Rate Impact	14.0%)
Levelized Annual Revenue Requirement	$329.6 Million

7/83

reimbursement hurdles in the bill, we assumed that all these costs must be absorbed by us. As shown in this exhibit, our customers would face a whopping 47.9% increase in their rates if H.R. 3400 becomes law. This impact is considerably higher than the OTA estimated 14% as Indiana's average. Even with a 90% capital cost recovery, our customers would still see their rates increase by 21.1% as shown in Exhibit 10. I would also like to caution that these cost estimates were generated in 1983. Based on the Company's extremely unfavorable financial situation, it is unlikely that we could even finance any capital cost. We do not know the cost of money today because of the financial uncertainties. Clearly though it was considerably more favorable in 1983. The cost of retrofit technology required to install controls at existing power plants is high compared to new installations. However, our estimated costs as shown in Exhibit 11 compare favorably with those by EPA and the Electric Power Research Institute (EPRI), and are on the low side of the range.

The third element of unwarranted optimism in the bill is on compliance schedules. Exhibit 12 contains a historical list of operational utility scrubbers in the U.S. Over the past 12 years the U.S. has added 111 scrubbers. Utilizing the size data on the power plants in Exhibits 1 and 2, we estimated the number of scrubbers which would be required just to bring the top 50 designated plants in compliance with H.R. 3400. A comparision of scrubbers in operation versus those required by the 50 plants is presented in Exhibit 13. It would be quite a feat nationally to build, install and have operational about 100 scrubbers within a period of two years, per Section 185 (c)(2)(B). We have contrasted the bill's requirement that each of the 50 plants have scrubbers operational within two (2) years after a con-

EXHIBIT 10

IMPACT OF H. R. 3400 ON PUBLIC SERVICE INDIANA WITH 90% CAPITAL REIMBURSEMENT

(1983 DOLLARS)

Total Capital Costs	$1.1 Billion
First Year (1990) Revenue Requirement	$171.0 Million
Rate Impact	21%

(OTA: Indiana Average Rate Impact 9.3%)

Levelized Annual Revenue Requirement	$172.4 Million

7/83

EXHIBIT 11

UTILITY SCRUBBER RETROFIT COSTS

COMPARATIVE ESTIMATES

(1983 Dollars)

Source	Capital Costs Dollars/kw
U.S. Environmental Protection Agency	260
Electric Power Research Institute	187-303
Edison Electric Institute Study	206-396
Public Service Indiana	187-220

All dollars adjusted to mid-1983 by Data Resources, Inc. "Utility Cost Forecasting Review."

FJM
2/84

EXHIBIT 12

OPERATIONAL UTILITY SCRUBBERS

Company	Unit	State
Alabama Electric Coop.	Tombigbee 2	AL
Alabama Electric Coop.	Tombigbee 3	AL
Arizona Electric Power Coop.	Apache 2	AZ
Arizona Electric Power Coop.	Apache 3	AZ
Arizona Public Service Co.	Cholla 1	AZ
Arizona Public Service Co.	Cholla 2	AZ
Arizona Public Service Co.	Cholla 4	AZ
Arizona Public Service Co.	Four Corners 1	NM
Arizona Public Service Co.	Four Corners 2	NM
Arizona Public Service Co.	Four Corners 3	NM
Associated Electric Coop.	Thomas Hill 3	MO
Basin Electric Power Coop.	Laramie River 1	WY
Basin Electric Power Coop.	Laramie River 2	WY
Basin Electric Power Coop.	Laramie River 3	WY
Big Rivers Electric Corp.	Green 1	KY
Big Rivers Electric Corp.	Green 2	KY
Central Illinois Public Service	Newton 1	IL
Central Illinois Light Co.	Duck Creek 1	IL
Cincinnati Gas & Electric Co.	East Bend 2	KY
Colorado Ute. Electric Assn.	Craig 1	CO
Colorado Ute. Electric Assn.	Craig 2	CO
Columbus & Southern Ohio Electric	Conesville 5	OH
Columbus & Southern Ohio Electric	Conesville 6	OH
Commonwealth Edison Co.	Will County 1	IL
Cooperative Power Assn.	Coal Creek 1	ND
Cooperative Power Assn.	Coal Creek 2	ND
Delmarva Power & Light	Delaware City 1	DE
Delmarva Power & Light	Delaware City 2	DE
Delmarva Power & Light	Delaware City 3	DE
Duquesne Light Co.	Elrama 1-4	PA
Duquesne Light Co.	FR Phillips 1-4	PA
East Kentucky Power Coop.	HL Spurlock 2	KY
Hoosier Energy Division	Merom 1	IN
Hoosier Energy Division	Merom 2	IN
Houston Lighting & Power Co.	W. A. Parish 8	TX
Indianapolis Power & Light	Petersburg 3	IN
Kansas City Power & Light	Hawthorn 3	MO
Kansas City Power & Light	Hawthorn 4	MO
Kansas City Power & Light	La Cygne 1	KS
Kansas Power & Light Co.	Jeffrey 1	KS
Kansas Power & Light Co.	Jeffrey 2	KS
Kansas Power & Light Co.	Jeffrey 3	KS
Kansas Power & Light Co.	Lawrence 4	KS
Kansas Power & Light Co.	Lawrence 5	KS
Kentucky Utilities Co.	Green River 1-2	KY
Lakeland Light & Water Dept.	McIntosh 3	FL
Louisville Gas & Electric Co.	Cane Run 4	KY
Louisville Gas & Electric Co.	Cane Run 5	KY
Louisville Gas & Electric Co.	Cane Run 6	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 1	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 2	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 3	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 4	KY
Louisville Gas & Electric Co.	Paddys Run 6	KY
Marquette Board Light & Power	Shiras 3	MI
Minnesota Power & Light	Clay Boswell 4	MN
Minnkota Power Coop.	Mt. Young 2	ND
Monongahela Power Co.	Pleasants 1	WV
Monongahela Power Co.	Pleasants 2	WV
Montana Dakota Utilities	Coyote 1	ND
Montana Power Co.	Colstrip 1	MT
Montana Power Co.	Colstrip 2	MT
Nevada Power Co.	Reid Gardner 1	NV
Nevada Power Co.	Reid Gardner 2	NV
Nevada Power Co.	Reid Gardner 3	NV
Northern Indiana Public Ser.	Dean H. Mitchell 11	IN
Northern Indiana Public Ser.	R. M. Schahfer 17	IN
Northern States Power Co.	Riverside (MN) 1-2-6	MN
Northern States Power Co.	Sherburne County 1	MN
Northern States Power Co.	Sherburne County 2	MN
Pacific Power & Light Co.	Jim Bridger 4	WY
Pennsylvania Power Co.	Bruce Mansfield 1	PA
Pennsylvania Power Co.	Bruce Mansfield 2	PA
Pennsylvania Power Co.	Bruce Mansfield 3	PA
Philadelphia Electric Co.	Cromby 1	PA
Philadelphia Electric Co.	Eddystone 1	PA
Philadelphia Electric Co.	Eddystone 2	PA
Public Service Co. of Indiana	Gibson 5	IN
Public Service New Mexico	San Juan (NM) 1	NM
Public Service New Mexico	San Juan (NM) 2	NM
Public Service New Mexico	San Juan (NM) 3	NM
Public Service New Mexico	San Juan (NM) 4	NM
Salt River Project	Coronado 1	AZ
Salt River Project	Coronado 2	AZ
San Miguel Electric Coop.	San Miguel 1	TX
Sikeston Bd. of Mun. Util.	Sikeston 1	MO
Southern Mississippi Electric Power	Morrow 1	MS
Southern Mississippi Electric Power	Morrow 2	MS
South Carolina Public Ser.	Winyah 2	SC
South Carolina Public Ser.	Winyah 3	SC
South Carolina Public Ser.	Winyah 4	SC
South Illinois Power Coop.	Marion 4	IL
Southern Indiana Gas and Electric Co.	AB Brown 1	IN
Springfield Utilities	Southwest 1	MO
Springfield Water, Light & Power	Dallman 3	IL
Tennessee Valley Auth.	Paradise 1	KY
Tennessee Valley Auth.	Widows Creek 7	AL
Tennessee Valley Auth.	Widows Creek 6	AL
Texas Municipal Power	Gibbons Creek 1	TX
Texas Power & Light Co.	Sandow 4	TX
Texas Utilities Gen. Co.	Martin Lake 1	TX
Texas Utilities Gen. Co	Martin Lake 2	TX
Texas Utilities Gen. Co.	Martin Lake 3	TX
Texas Utilities Gen. Co.	Monticello (TX)	TX
United Power Association	Stanton 1	ND
Utah Power & Light Co.	Hunter 1	UT
Utah Power & Light Co.	Hunter 2	UT
Utah Power & Light Co.	Hunter 3	UT
Utah Power & Light Co.	Huntington 1	UT
Utah Power & Light Co.	Naughton 3	WY
West Penn Power	Mitchell 3	PA
	Total FGD Systems	111

SOURCE: EEI 9/83

EXHIBIT 13

OPERATIONAL UTILITY SCRUBBERS
COMPARED TO
SCRUBBERS REQUIRED BY H.R. 3400

SCRUBBERS OPERATIONAL*	SCRUBBERS TO BE COMPLETED IN 2 YEARS UNDER H.R. 3400
45,750 MW	64,410 MW
114 UNITS	100 UNITS**

* SOURCE: EPA 12/83

** ESTIMATED

tract to purchase with a more realistic construction schedule in Exhibit 14. The time estimates show that an achievable compliance schedule is five (5) years.

Exhibits 15, 16 and 17 focus on the site specific constraints when retrofitting is considered. These PSI sites - two (2) of the top 50 - show the physical limitations and the difficulty associated with any massive scrubbers installation. The Gibson power plant in Exhibits 15 and 16 would require four (4) additional scrubbers to comply with H.R. 3400. This may require erecting costly superstructures in order to overcome physical space limitations to accommodate scrubbers.

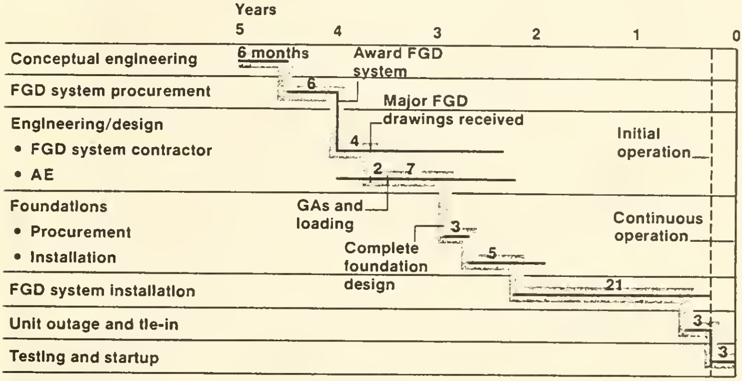
In summary, the three fundamental flaws of H.R. 3400 which would weaken Indiana economy and unjustly penalize our customers are:

1. Only power plants, predominantly in the Midwest are controlled, even though the bill is hailed as national in scope and presumably to control all sources. The power plant selection process appears highly arbitrary, making intended ecological improvements very costly.

2. The gap between cost of controls and anticipated revenues from the electric energy fee follows the well known deficit pattern of our national budget process. If H.R. 3400 is enacted, Indiana would very likely be shortchanged, and our customers would face a 47.9% rate increase.

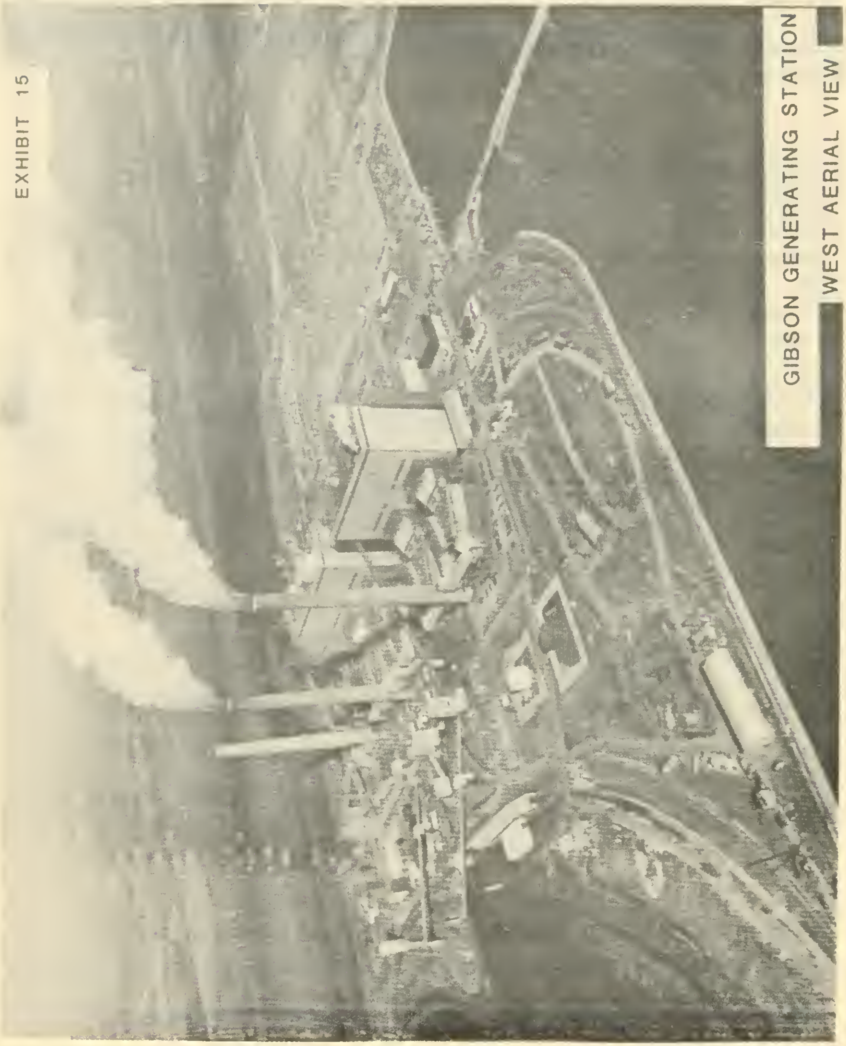
EXHIBIT 14

Schedule of Critical Path Activities for FGD System Backfit



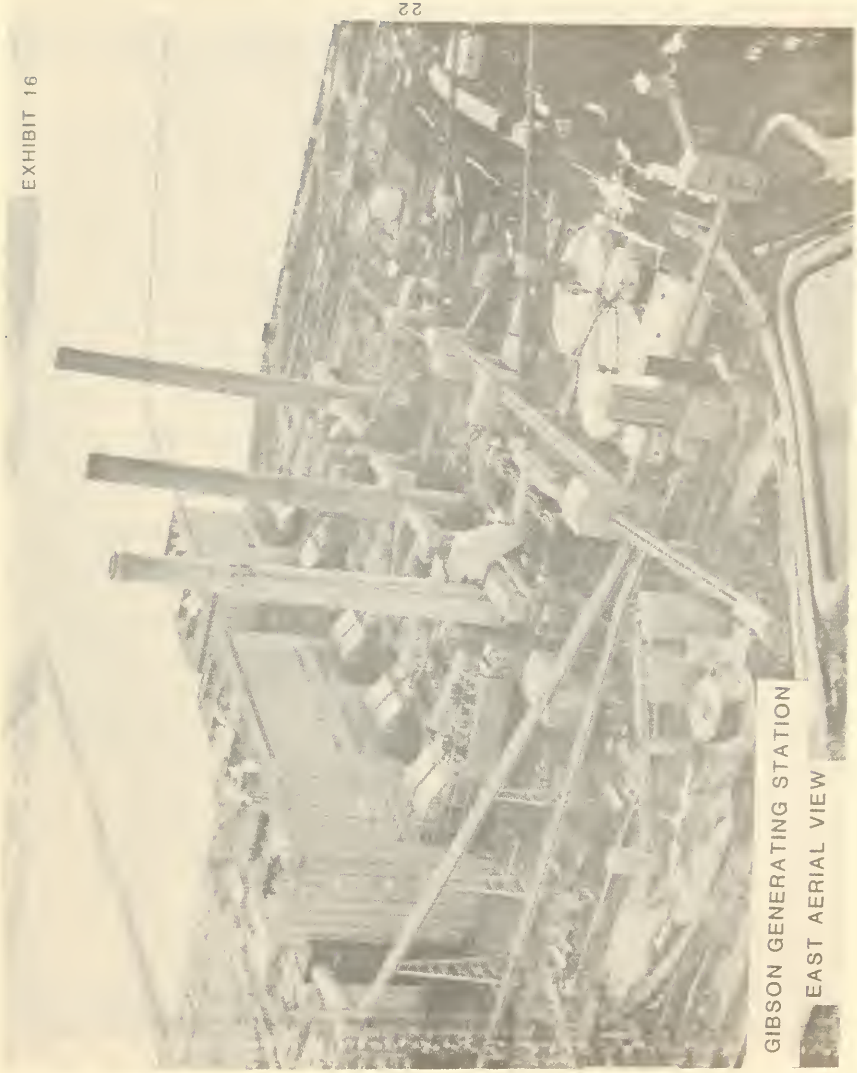
21

EXHIBIT 15



GIBSON GENERATING STATION
WEST AERIAL VIEW

EXHIBIT 16

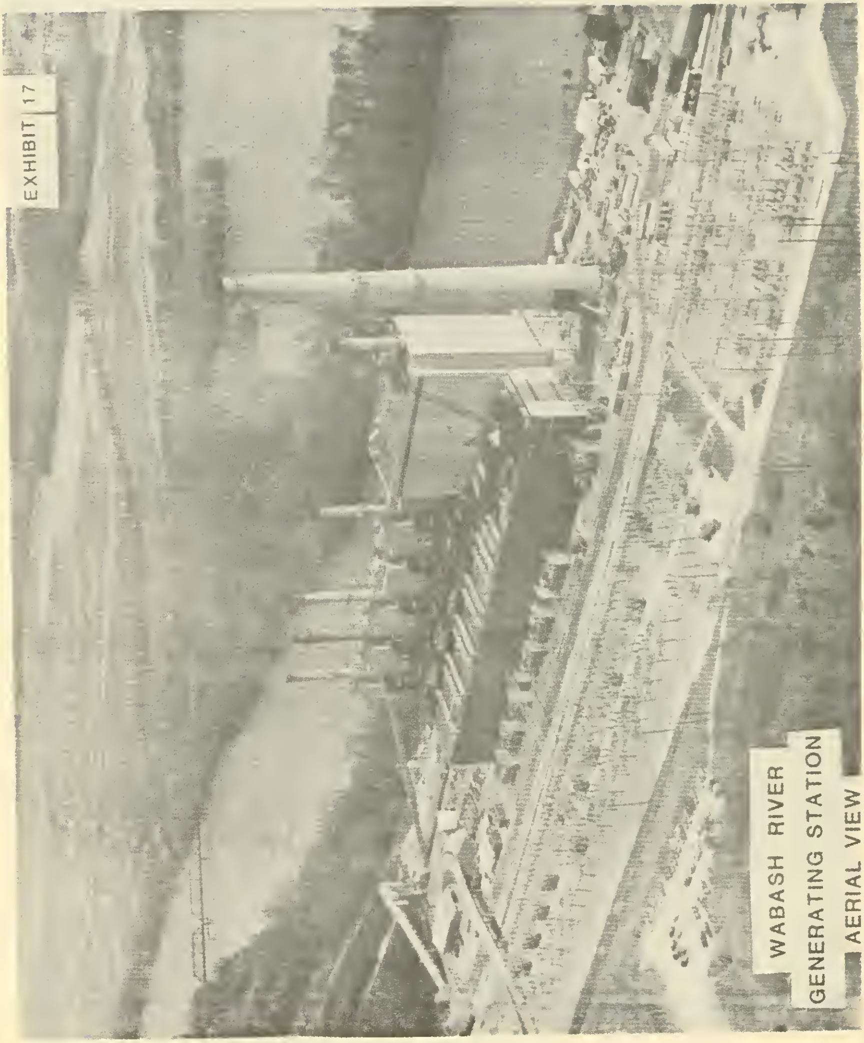


GIBSON GENERATING STATION

EAST AERIAL VIEW

23

EXHIBIT 17



WABASH RIVER
GENERATING STATION
AERIAL VIEW

3. The compliance schedule is exceedingly ambitious, and realistically unachievable.

Facts on Acid Rain

Let me now review these facts about acid deposition with you:

EPRI and the electric utility industry have been conducting major acid rain research programs over the past several years. One such project involves monitoring acid precipitation in the eastern U.S. The results of this project are shown in Exhibit 18. The data points out that there is no variation in acidity of precipitation between the Northeast and the Midwest. A review of the data also indicates that there is no apparent long term trend of increasing acidity. It should be mentioned here that since 1975, midwestern utilities and the Tennessee Valley Authority have reduced SO2 emissions by over 20%, or about 2.5 million tons. This significant reduction however, has not resulted in any measurable change in the acidity of rain.

Midwestern utilities have already made a significant reduction in their SO2 emissions, and as shown in Exhibit 19, the trend will continue for the rest of this century. The projected reductions in SO2 emissions by the year 2000 show that current Midwest emissions will decrease by another one (1) million tons. These emission reductions will occur although the projected coal consumption during the same period will increase by 41 million tons, or about 25%. This latter projection is presented in Exhibit 20.

EXHIBIT 18

LOWEST MEAN pH

(ANNUAL WEIGHTED: January 1979 - June 1982)

UTILITY ACID PRECIPITATION STUDY PROGRAM

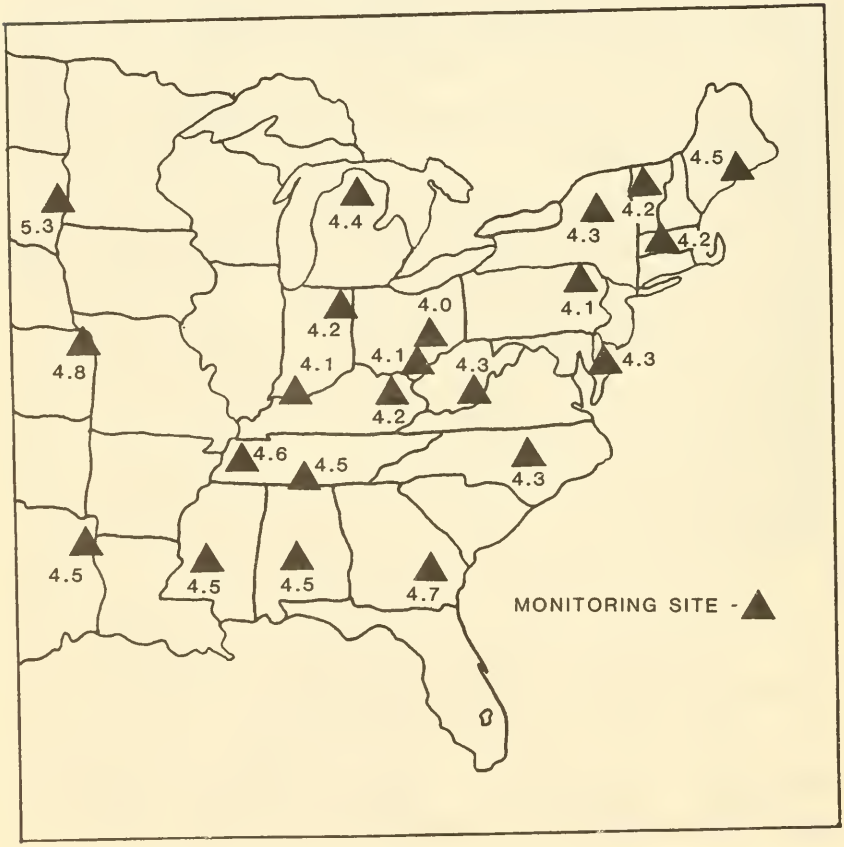


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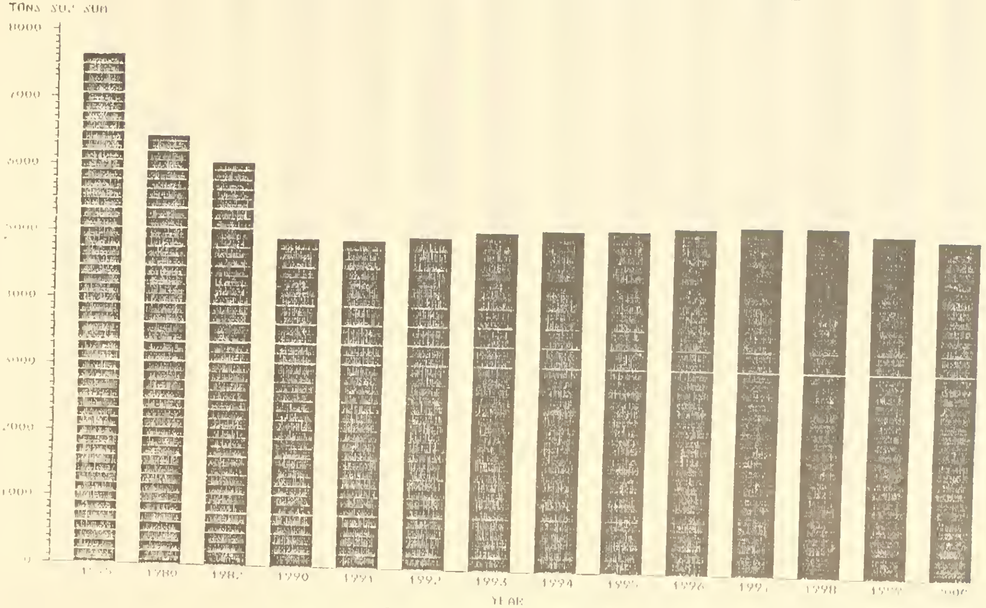
EXHIBIT 19

MIDWESTERN UTILITIES SO2 EMISSIONS PROJECTED FOR 1990 THROUGH 2000

SO2 EMISSIONS IN THOUSANDS OF TONS



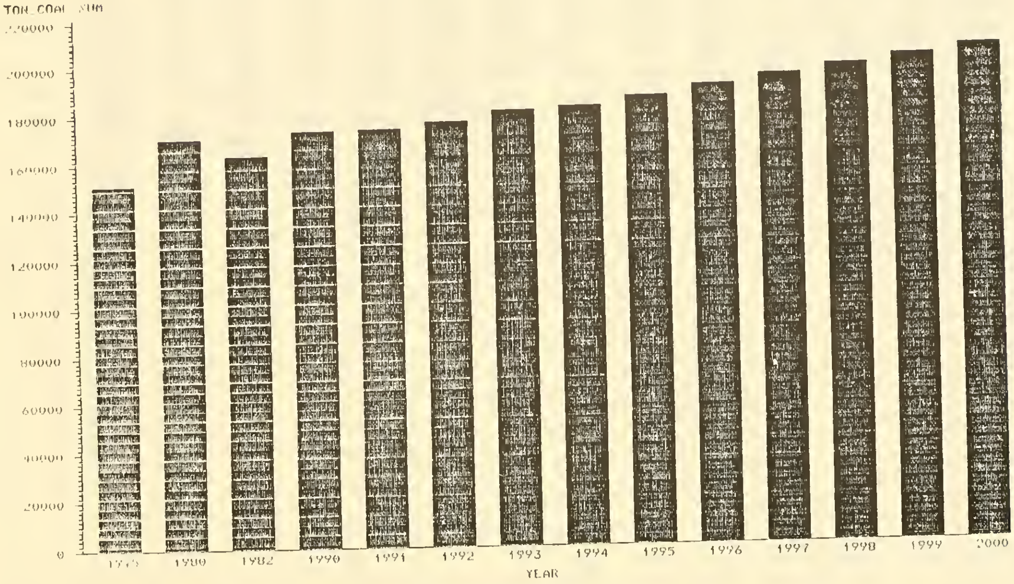
CEEB EMISSION DATA

PUBLIC SERVICE INDIANA
SEPTEMBER 1985 RAM

EXHIBIT 20

MIDWESTERN UTILITIES COAL CONSUMPTION PROJECTED FOR 1990 THROUGH 2000

COAL CONSUMPTION IN THOUSANDS OF TONS



CEEB EMISSION DATA

PUBLIC SERVICE INDIANA
SEPTEMBER 1983 RAM

Recommendations

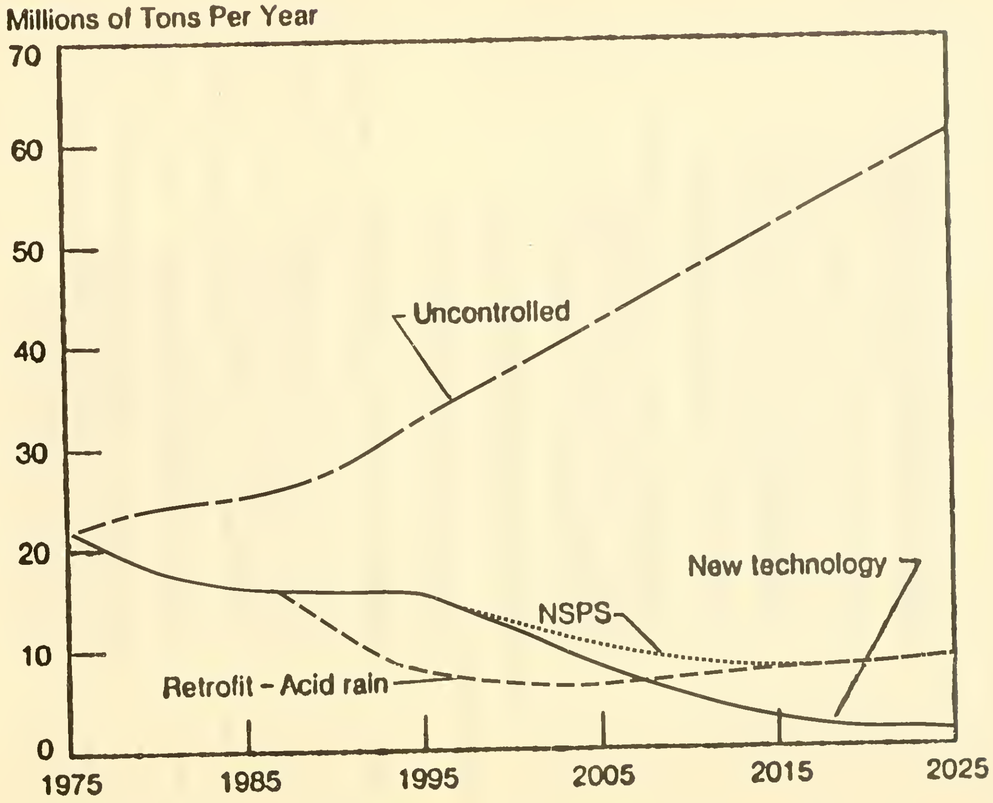
The material reviewed thus far emphasizes the vital need for accelerated research on the causes and effects of acid rain prior to imposition of any controls. EPRI has spent about $70 million to date and has budgeted an additional $175 million over the next five (5) years. It is imperative that national acid rain research programs be increased in funding and accelerated in schedule, in order to generate information useful to the U.S. Congress in the national policy making process. Legislation similar to H.R. 1405 by Congressman Rahall (WVa) should be expedited. Additionally, Congress should encourage area specific mitigation strategies. For example, liming of acidic lakes in ecologically sensitive areas would yield rapid, cost effective improvements.

Exhibit 21 contains a fascinating message for this Subcommittee. The graphs were prepared by the EPA and express different scenarios of emission reductions. The 'retrofit acid rain' scenario is based on another bill (S.768) which calls for somewhat similar reduction as sought byH.R. 3400. Also shown in this exhibit is the 'new technology' or the clean combustion technology development scenario which would result in vastly lower emissions than obtained through acid rain controls.

Instead of embarking on a 'controls now' program—which could cost $100 billion—this nation would be well ahead in its technological progress and lasting emission reductions by investing these sums on

EXHIBIT 21

UTILITY SO_x EMISSION TRENDS



clean combustion technology development. Included in this category are fluidized bed combustion, coal gasification and limestone injection multistage burner (LIMB). I recommend that Congress promote clean combustion technology development as a positive means to achieve pollutant reduction.

I have summarized my recommendations on acid rain and H.R. 3400 in Exhibit 22. Specifically, I urge this Subcommittee to consider favorable action to:

- Greatly increase funding and accelerate acid rain research.
- Encourage through grants, mitigation strategies such as liming of acid lakes in ecologically sensitive areas.
- Promote, through funding, development of clean combustion technologies as a national resolve, to produce efficient systems which would reduce air pollutants nationwide.

I thank you for giving me this opportunity.

EXHIBIT 22

RECOMMENDATIONS ON ACID RAIN AND H.R. 3400

- **Accelerate national acid rain research programs** through increased funding for the National Acid Precipitation Assessment Plan and enhance its current schedules. Useful scientific data must be expeditiously generated on atmospheric processes and ecosystem impact.

- **Support** mitigation strategies such as **liming of acidic lakes.**

- **Promote** accelerated development of **clean combustion technologies as a national resolve.** Divert funds from acid rain control quick fixes to develop efficient systems which would reduce the pollutants burden nationally.

Mr. WAXMAN. Thank you very much.
Mr. Winter.

STATEMENT OF DALE D. WINTER

Mr. WINTER. Today I am testifying on behalf of the Indiana Statewide Association of Rural Electric Cooperatives, which is the association for 40 Indiana rural electric member cooperatives, which provide electrical services to the rural communities and businesses of the State of Indiana.

I am the manager of environmental affairs and fuels for Hoosier Energy Rural Electric Cooperative, Inc., which is a Bloomington-based generation and transmission rural electric cooperative, owned and controlled by 18 rural electric distribution cooperatives serving a half million residents, businesses, and farms in the southern half of the State.

Since obtaining a master of science degree in environmental engineering, I have worked in the area of environmental affairs, not only for the utilities, but also private industry.

I am also a registered professional engineer in the States of Indiana, Illinois, and Missouri.

What is the acid rain fall issue? To us, it is an issue of uncertainties. It is an issue that the scientific community cannot agree upon, such as if a reduction in the SO_2/NO_x emissions in the Midwest, we'll have a corresponding reduction in the acid rain deposition in the Northeast, versus emission reductions in the sensitive regions being impacted by acid deposition.

It's also an issue that has divided the legislative community, and divided not only the various regions of the United States, but also the electric industry, and pitted stationary sources versus mobile sources.

We realize today that we have neither the time, nor the resources available to aid you in resolving these uncertainties, so, rather than testifying on the status of the scientific data and what type of legislation it does or does not support, or a number of unresolved issues on this question, we would like mainly to address the item that we do know with a large degree of certainty can assess our own and feel we are qualified to assess.

That item is the impact of the various pending House and Senate bills that propose various reduction SO_2/NO_x emissions from the States in the Midwest region, and are directed at reductions mainly from coal-fired boilers.

More specifically, I will address the impact on rural southern Indiana, which is the area serviced by Hoosier Energy.

Hoosier Energy operates two coal-fired generation facilities. One plant is located in Petersburg, Ind., consisting of two units without flue gas desulfurization systems, and which began commercial operation in 1970.

The second generation facility is located near Merom, Ind., consists of two units equipped with flue gas desulfurization, and this plant began commercial operation in 1980.

An assessment of the impact from the various pieces of legislation on Hoosier Energy Systems, depending on the final legislation for reducing SO_2/NO_x emissions indicates that a large increase in the cost of electrical service to our consumer members will be necessary.

The legislation being discussed today identifies 50 utilities and it calls for a 10-million-ton reduction. The 50 utilities will not account for the total 10-million-ton reduction, and Hoosier Energy is not 1 of the 50 utilities. Thus, we can assume that our member systems will be required to bear the cost of any additional reduction required above that of the 50 utilities.

Since we don't know how the remaining tonnage will be obtained from the other utilities, we can't develop the cost of this, but we have done so with other bills.

One bill, being Senate bill 3041, which was reported out of the Senate committee last year, calls for an 8-million ton reduction of SO_2/NO_x emissions from 31 States.

Indiana's reduction requirement would be approximately 14 percent of the total required emission reduction based on the method of calculating emission reductions which was detailed in the bill.

Also, this bill sets 1980 SO_2/NO_x emissions as the base line for reductions; thus, not exempting Hoosier Energy's new facility, which does meet the new source performance standards.

By this bill, Hoosier Energy would be required to reduce our system emissions by 86.4 percent. Due to this large reduction, the alternatives to obtain the reduction were few. They consisted of burning a low sulfur coal at the new facilities, which is equipped with a scrubber, and closing the old facility unless SO_2 emission reductions could be purchased from another utility.

If this bill were passed, or the same type of reduction was required by the bill presently being discussed, the cost to our members will be a first year percent rate increase of 31.7 percent, or a levelized 5-year percentage rate increase of 35.8 percent, which would add approximately $426 to $480 per year to the annual household costs for our consumers to purchase electricity.

Hoosier Energy has also assessed the impact of proposed bills calling for emission ceilings of 1.2 pounds per million Btu SO_2 emissions, or an 85-percent reduction in the total yearly SO_2 emissions.

These bills would have exempted our new facility, and allowed us to keep our older facility in operation by either burning a low sulfur coal from the west or installing scrubbers.

The production cost increase for the older facility would be 62 percent for low sulfur coal to 44 percent for scrubbers if it was physically possible to install the scrubbers.

This would translate into a cost of $118 to $106 [sic] per year to the annual household costs of our customers.

We are sure that you gentlemen are aware of the cost to other individual utilities. The estimated cost developed by Edison Electric Institute and the $15 billion to $220 billion cost estimates that have been developed based on the magnitude of the reductions required by the final legislation.

If the real objective is to reduce perceived adverse environmental effects of acid deposition from manmade sources—not just to reduce gross emissions as an end in and of itself—the best scientific evidence presently available doesn't support the expenditure of these enormous sums of money to reduce emissions in the Midwest.

Data developed by the Department of Energy predicts that the SO_2/NO_x emissions should be stable over the next 10 to 12 years before starting to decline.

This presents an excellent opportunity to obtain the data necessary to determine if reductions in utility and other manmade pollutants emissions and specific reasons will resolve the acid rainfall problem in particularly sensitive environments.

It also will allow the utility industry to complete the studies on various alternative control measures that can substantially reduce the cost of any required emission reduction.

It is the opinion of the Indiana Rural Electric Cooperatives that the prudent and wise course of action would be to continue and complete the ongoing research, use possible mitigating measures, if necessary, in the sensitive areas, and when such research indicates that various reduction is needed, they should be implemented based on a fair and equitable basis.

Also in examining the various bills that have been proposed that call for various reduction schemes, there is one common point. That point is that the brunt of these bills is directed toward a handful of States, and the Midwest, with Indiana being one of those States.

These bills will definitely add an additional economic burden to the State of Indiana, and add the risk of thwarting future economic recovery through future pollution control measures that are not based on sound scientific data.

A resolution stating the position of the Indiana Statewide Association of Rural Electric Cooperatives is included with my written testimony, along with the various items referred to in my discussion today.

Thank you.

[Testimony resumes on p. 614]

[Mr. Winter's prepared statement follows:]

Testimony on Acid Deposition Legislation

by

Dale D. Winter

on behalf of

Indiana Statewide Association

Today I am testifing on behalf of the Indiana Statewide Association (ISA) of Rural Electric Cooperatives, which is the association for 40 Indiana Rural Electric Member Cooperatives which provide electrical service to the rural communities and businesses of the State of Indiana. I am the Manager of Environmental Affairs and Fuels for Hoosier Energy (HE) Rural Electric Cooperative, Inc., which is a Bloomington based Generation and Transmission Rural Electric Cooperative owned and controlled by 18 rural electric distribution cooperatives serving 500,000 residents, businesses, and farms in the southern half of the State. Since obtaining a Master of Science Degree in Environmental Engineering, I have worked in the area of environmental affairs not only for utilities, but also private industry. I also am a Registered Professional Engineer in the States of Indiana, Illinois, and Missouri.

What is the acid rainfall issue? To us it is an issue of uncertainties. It is an issue that the scientific community cannot agree upon, i.e., if a reduction in SO_2/NO_x emissions in the midwest will have a corresponding reduction in acid-deposition in the Northeast vs. emission reductions in the sensitive regions being impacted by acid depositions. It is also an issue that has divided the legislative community, an example being the various bills presently being considered for emission reductions of 4 million, 8 million, 10 million or 12 million tons of SO_2/NO_x in the midwest region, 31 States, or 50 largest utilities. It is an issue that has divided not only the various regions of the United States, but also the electric industry and pitted stationary sources versus mobile sources. We realize that today we have neither the time nor the resources available to aid you in resolving these uncertainties.

So rather than testify on the status of the scientific data and what type of legislation it does or does not support; whether the acid deposition issue should be a regional or a national issue with the cost shared; if local or long distant man-made sources are the cause of acid deposition in the Northeast; or a number of unresolved questions on this issue; we would like mainly to address the item that we do know with a large degree of certainty, can assess on our own and feel we are qualified to assess.

That item is the impact of the various pending House and Senate bills that propose various reductions in SO_2/NO_x emissions from the States in the Midwest region and are directed at reductions mainly from coal-fired boilers. More specifically, I will address the impact on rural Southern Indiana which is the area serviced by Hoosier Energy.

Hoosier Energy operates two coal-fired generation facilities. One plant is located near Petersburg, Indiana, consisting of two units without Flue Gas Desulfurization System (Scrubber), and which began commercial operation in 1970. The second generation facility is located near Merom, Indiana, consisting of two units equipped with a Flue Gas Desulfurization System, and this plant began commercial operation after 1980 (Unit No. 2 in February, 1982 and Unit No. 1 in September, 1983). An assessment of the impact from the various pieces of legislation on Hoosier Energy's system, depending on the final legislation for reducing SO_2/NO_x emissions, indicates that a large increase in the cost of electrical services to our consumer members will be necessary.

Senate Bill 3041, which was reported out of Senate Committee last year, calls for an 8 million ton reduction in SO_2/NO_x emissions from 31 states. Indiana's reduction requirement would be 1,115,770 tons or approximately 14% of the total required emission reduction based on the method of calculating emission reductions (if States cannot reach agreement amongst themselves on the required tonnages) which was detailed in the bill. Also, this bill sets the 1980 SO_2/NO_x emissions as the base-line for reductions, thus not exempting HE's new facility which does meet the present New Source Performance Standards.

HE's older facility without scrubbers is permitted to emit 54,000 tons SO_2 per year, while the new facility equipment with scrubbers and approximately four times larger than the old facility is permitted to emit 53,484 tons SO_2 per year. The total tonnage emitted by these two facilities is 107,484 tons SO_2 per year. HE's required tonnage reduction would be 82,989 tons per year based on Indiana's total required tonnage reduction since the new facility was not in operation in 1980.

Due to this large reduction (86.4%) the alternatives to obtain the reduction were few. They consisted of burning a lower-sulfur coal at the new facility and closing the older facility unless SO_2 emission reductions could be purchased from another utility. If this bill is passed, the cost to our members will be a first-year percentage rate increase of 31.7% or a levelized five-year percentage rate increase of 35.8% which would add approximately $426-480 per year to the annual household cost for our consumers to purchase electricity.

HE has also assessed the impact of proposed bills calling for an emission ceiling of 1.2 $\#SO_2$/mmBtu heat input to the boiler (NSPS) or an 85% reduction in total yearly SO_2 emissions (S.1706-Mitchell, S.1709-Moynihan, H.R. 4829, and H.R. 4816). These bills would have exempted HE's new facility and allowed us to keep HE's older facility operational by either burning low-sulfur coal from the West or installing scrubbers. The production cost increases from the older facilities would be 62% (low sulfur coal) to 44% (scrubbers if physically possible to install). This would translate into a cost of $118 to $106 per year to the annual household cost of our consumers or a rate increase to our memebers of 8% or 9%.

Conclusion

We are sure that you gentlemen are aware of the cost to other individual utilities, the estimated cost developed by Edison Electric Institute and the 15 billion to 220 billion dollar cost estimates that have been developed based on the magnitude of the reductions required by the final legislation. If the real objective is to reduce the perceived adverse environmental effects of acid deposition from man-made sources (not just to reduce gross emissions as an end in and of itself), the best scientific evidence presently available does not support the expenditure of these enormous sums of money to reduce emissions in the Midwest.

Data developed by the Department of Energy predicts that SO_2/NO_x emissions should be stable over the next 10-12 years before starting to decline. This presents an excellent opportunity to obtain the data necessary to determine if reductions in utility and other man-made pollutânt emissions in specific regions will resolve the acid rainfall (deposition) problem in particularly sensitive environments. It also will allow the utility industry to complete the studies on various alternatives (LIMB, fluidized-bed combustion, etc.) control measures that can substantially reduce the cost of any required emission reduction. It is the opinion of the Indiana Rural Electric Cooperatives that the prudent and wise course of action would be to continue and complete the ongoing research, use possible mitigating measures, if necessary, in the sensitive areas (lake liming, etc.) and when such research indicates that various reductions are needed, they should be implemented based on a fair and equitable basis.

Also in examining the various bills that have been proposed that call for various reduction schemes, there is one common point. That point is that the brunt of these bills are directed towards a handful of States (OH, IN, PA, MO, IL, KY, TN, WV) in the Midwest with Indiana being one of those States. These bills will definitely add an additional economic burden to the State of Indiana and add the risk of thwarting future economic recovery through further pollution control measures that are not based on sound scientific data.

A resolution stating the position of the Indiana Statewide Association of Rural Electric Cooperatives is included with my written testimony along with various items referred to in my discussion today.

Resolution on Acid Deposition as adopted at the Indiana Statewide Association of REC's Annual Meeting on December 13, 1983.

RESOLUTION NO. 6

ACID PRECIPITATION

Whereas, It is recognized that coal-fired generating plants generate SO_2 and NO_X and that various authorities have suggested that these gases are significant factors in producing "acid rain" and that some studies indicate acid precipitation has detrimental environmental impacts, and

WHEREAS, there is an inadequate body of scientific data to determine the cause, transport and extent of acid precipitation and there is no validated scientific basis for assuring that a reduction in electric utility emissions will result in a reduction of acid precipitation, and

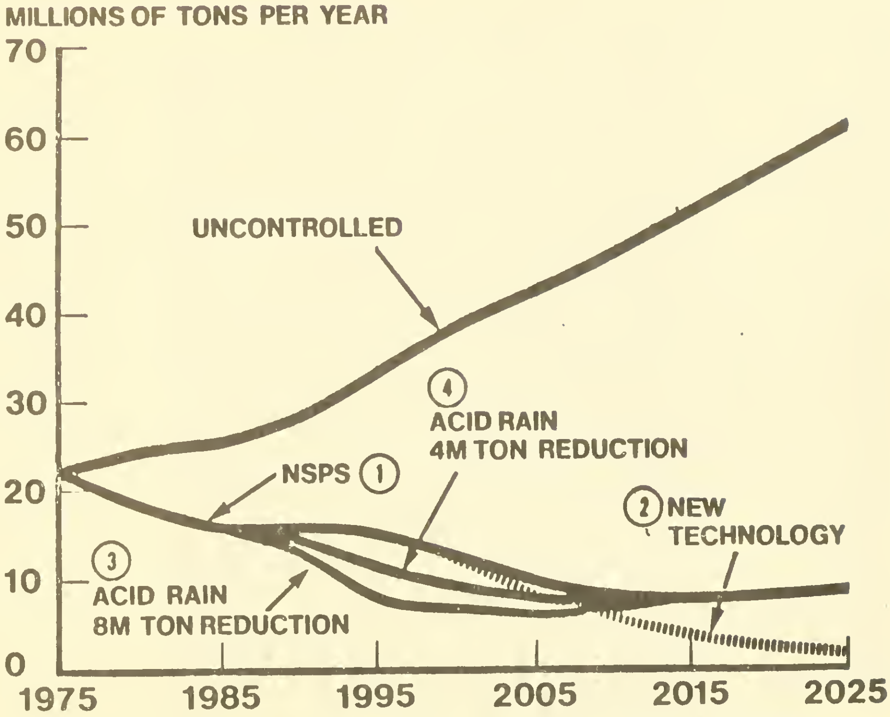
WHEREAS, premature and ill-advised efforts to correct what is perceived to be a problem may do grave harm to the nation's economy and efforts to carry out its policy to expand domestic coal consumption, and

WHEREAS, Congress has recognized the issue and mandated a ten-year study to identify the causes and effects of acid precipitation and actions to limit or ameliorate harmful effects, and all segments of the utility industry are supporting efforts of EPRI to identify the cause and extent of the problems and develop workable solutions thereto, therefore, be it

RESOLVED, that we urge Indiana Statewide Association of RECs, through its Congressional Relations Department to cooperate with and assist NRECA in efforts to convince members of Congress from Indiana and all other states to refrain from enactment of legislation and to urge EPA to refrain from promulgation of regulations relating to acid precipitation until the aforementioned studies have been completed, therefore, be it

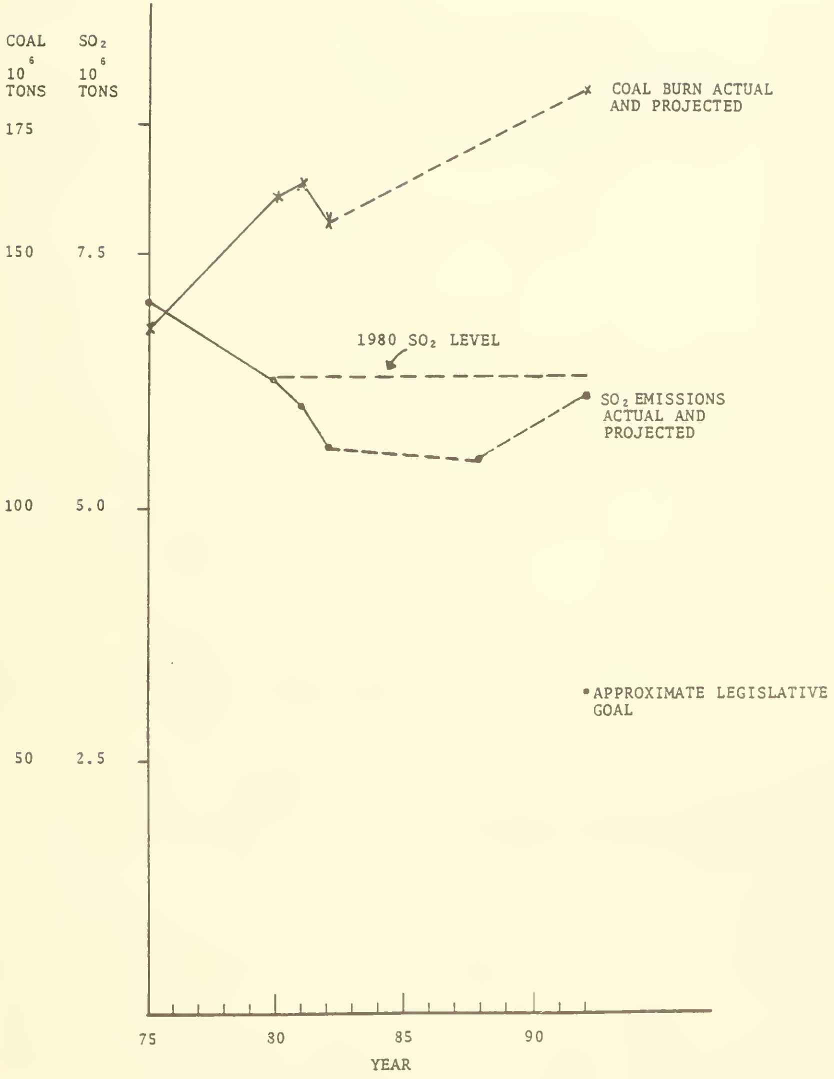
FURTHER RESOLVED, that we vigorously support reasonable legislative proposals to accelerate congressionally mandated research to establish an adequate body of scientific data as to the causes and effects of acid precipitation.

UTILITY SO_2 EMISSION TRENDS



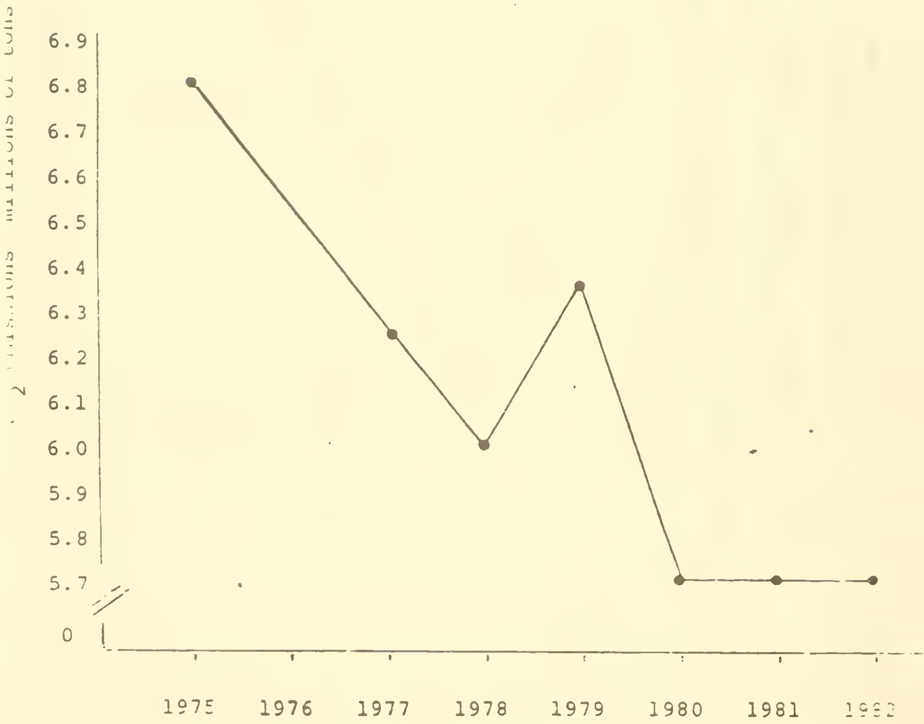
BASED ON EPA DATA AND PROJECTIONS ADJUSTED BY EPRI
TO REFLECT CURRENT UTILITY GROWTH PROJECTIONS

ECAR AREA
COAL BURN VS SO_2 EMISSIONS



*Covers coal burning plants of ECAR bulk power members and major plants of Liaison members; does not cover TVA plant in Kentucky.

Historical SO_2 Emissions
ECAR Region 1975-1982*



* 1982 is a preliminary estimate

ECAR MEMBER COMPANIES

Appalachian Power Company
The Cincinnati Gas & Electric Company
The Cleveland Electric Illuminating Company
Columbus and Southern Ohio Electric Company
Consumers Power Company
The Dayton Power and Light Company
The Detroit Edison Company
Duquesne Light Company
East Kentucky Power Cooperative, Inc.
Hoosier Energy Rural Electric Cooperative, Inc.
Indiana & Michigan Electric Company
Indiana-Kentucky Electric Corporation
Indianapolis Power & Light Company
Kentucky Power Company
Kentucky Utilities Company
Louisville Gas and Electric Company
Monongahela Power Company
Northern Indiana Public Service Company
Ohio Edison Company
Ohio Power Company
Ohio Valley Electric Corporation
Pennsylvania Power Company
The Potomac Edison Company
Public Service Company of Indiana, Inc.
Southern Indiana Gas and Electric Company
The Toledo Edison Company
West Penn Power Company

The figures below represent expenditures required to reduce coal-fired boiler SO_2 emissions by 8,000,000 tons per year below the 1980 level. S. 3041 (97th Congress) and S. 768 (98th and present Congress) mandate this reduction be completed within the next ten years.

G&T Owner & Operator (Location)	Capital Cost (1982 $)	Average Yearly Revenue Requirement for First Five Years (1982 $)	Average Yearly Household Cost for the first Five Years (1982 $)
Alabama Electric Co-op Inc. (AL)	*	3,500,000	20.00
Associated Electric Co-op. Inc. (MO)	371,275,000	61,452,255	170.50**
Big Rivers Elec. Corp. (KY)	260,500,000	41,669,000	117.00
Buckeye Pwr., Inc. (OH)	*	73,000,000	N/A
Central Elec. Pwr. Corp. (MO)	5,675,109	4,823,843	96.48
Central Elec. Co-op Inc. (SC)	29,721,120	4,807,302	3.88
Dairyland Pwr. Co-op (WI)	118,400,000	37,000,000	220.00
E. Ky. Pwr. Co-op (KY)	20,000,000	24,802,149	72.95
Hoosier Energy REC (IN)	*	72,635,000	480.00
So. Miss. EPA (MS)	16,900,000	7,300,000	33.00

N/A at the time of printing this information is not available.
*The alternative chosen requires no capital cost, e.g., burning low sulfur coal in some situations.
**This cost cannot be directly calculated. The figure shown represents an approximation.

IMPACT OF STAFFORD BILL ON CAPITAL & OPERATING EXPENSES FOR SELECTED UTILITIES

UTILITY	TOTAL CAPITAL EXPENDITURES (1982 BILLION DOLLARS)	CAPACITY SCRUBBED (THOUSAND MW)	CAPACITY LOST DUE TO SCRUBBING (THOUSAND MW)	ANNUAL COSTS (BILLION DOLLARS)	
				FIRST YEAR 1993	FIVE YEAR LEVELIZED 1993 - 1998
THE SOUTHERN COMPANY	2.3	7.2	0.4	0.7	0.6
ILLINOIS POWER COMPANY	0.6	1.8	0.2	0.2	0.1
PUBLIC SERVICE INDIANA	0.6	2.3	0.0	0.2	0.2
INDIANAPOLIS P&L COMPANY	0.4	1.2	0.1	0.2	0.1
DETROIT EDISON	0.9	3.0	0.1	0.4	0.3
UNION ELECTRIC COMPANY	0.9	3.4	0.1	0.3	0.3
INDIANA MICHIGAN (AEP)	1.9	2.2	0.2	0.4	0.2
OHIO POWER COMPANY (AEP)	2.9	3.2	0.3	0.7	0.5
VEPCO	1.2	2.8	0.2	0.2	0.2
WISCONSIN ELECTRIC POWER	0.7	1.8	0.1	0.2	0.2
OTHER 14 UTILITIES IMPACTED	2.9	10.3	0.4	1.6	1.3
TOTAL ALL RESPONDENTS	15.3	39.2	2.1	5.1	4.0

Mr. WAXMAN. Thank you very much.

Mr. McKnight.

STATEMENT OF ROBERT A. McKNIGHT

Mr. McKNIGHT. Thank you.

IPL is deeply concerned that the national debate about acid rain will lead to action that will cost our customers hundreds of millions of dollars in electric bill increases with no proof that such expenditures are even required or would be effective.

As a political debate over acid rain overshadows the limited, but expanding scientific knowledge of acid deposition and its effects, we need to remind our customers and you, our elected officials, that we are talking about spending in excess of $400 million of this community's capital resources. This has a $148 million annual price tag to our customers. It is safe to say that the resulting 25- to 35-percent increase in rates required would result in a lot of human hardship in our community.

Much is at stake in this public policy debate. We cannot forget that people pay electric bills, not utilities.

IPL serves approximately 336,000 households and businesses where 1.2 million people live and work. It would be the height of irresponsibility for us to subject our customers to such costs without clear scientific evidence that the Midwest coal-burning emissions are the problem.

Furthermore, we need reasonable evidence that these major investments in fuel switching and retrofitting on older units will have a meaningful effect.

Therefore, IPL, in behalf of our customers, calls for expanded research to answer the questions raised by the National Academy of Sciences findings, which state:

"Continued research is needed to determine the scientific causes of acid rain." That's page 11 of the NAS Summary Report.

"There is no guarantee—no guarantee—that Midwest emission reductions will work in solving lake acidification in environmentally sensitive areas." That's page 5 of the NAS Summary Report.

"Atmospheric models are inadequate to predict the consequences of emission reductions between specific localities." That's page 6 of the NAS Summary Report.

"Local pollution sources impact more than remote sources." Page 10 of the NAS Summary Report.

Reliable long-term data is sparse.

This is our position: It is a position our customers demand that we take. The people of this community demand clear and thorough scientific data, not rhetoric, to justify the enormous costs of the proposed legislation.

IPL and the people of central Indiana are not the insensitive polluters that we are often portrayed as being by career activists in the environmental movement and our friends in Canada.

IPL has long been a leader in pollution control, having invested in excess of $290 million in environmental control equipment. Overall expenditures to protect environment amounted to 17 cents out of every revenue dollar during 1982.

As the technology became available, IPL was the first to install a wet limestone scrubbing system on a major high sulfur coal-burning boiler in the United States.

Since 1973, IPL has reduced its total sulfur emissions by approximately 30 percent, while increasing its annual coal burn by nearly 34 percent.

These reductions have been made while continuing to use our Indiana coals.

The so-called easy to get sulfur reductions have been made, and any further constraints will be extremely expensive.

IPL is taking a progressive stance in all types of environmental research through membership in the Electric Power Research Institute. They are doing extensive research on acid rain, as well as many projects to test and develop new technologies. The company is a charter member in the Utility Acid Precipitation Study Program, which samples rain pH, as well as other parameters, on a continuing basis over the Eastern United States. This monitoring program is yielding high quality data designed to lead to a better understanding of the processes occurring, so effective decisions can be made on a scientific basis.

In January of this year, the company held the ground-breaking ceremony for a new and innovative SO_2 and NO_x removal test facility designed to test the Ebara dry flue gas scrubbing process. IPL is joined in this experiment by the Indiana Energy Development Board, under the leadership of the Governor and Lieutenant Governor, the Federal Department of Energy, Amax Coal, CF Industries, Ebara Corp., and the other investor-owned utilities in the State.

If successful, this new technology system will have a high removal efficiency of both SO_2 and NO_x, and, hopefully, will be less expensive than today's systems. It will yield as a byproduct, a high-grade fertilizer component which is badly needed in the Midwest farm belt.

No promises can be made when or even if the system can be available commercially. However, if success is achieved, the ratepayer, the farmer, and the environment all benefit.

There must be time to properly test and develop this and other experimental systems to assure that they are technically effective and affordable to our ratepayer.

IPL has a solid record of protecting the environment. When given the choice, we have made those investments prudently, based upon solid scientific and engineering fact. A multibillion-dollar unjustified experiment, as reflected in H.R. 3400 and the other Federal legislative proposals is against the best interests of our customers and our community.

Thank you for the opportunity of appearing.

Mr. SIKORSKI. I think you get credit for coming in under the bell.

Mr. WAXMAN. Thank you very much for that testimony.

Mr. McKnight, let me start with you.

The following statement you have made to us:

> In my remaining time, I would like to convince the members of the committee that IPL and the people of central Indiana are not the insensitive polluters that we are often portrayed as being, by career activists in the environmental movement and our friends in Canada.

That's what you are attempting to convince us. Do you think it is inaccurate to say that Indiana emits more sulfur dioxide than any other State in the Nation except Ohio?

Mr. McKnight. Indianapolis Power & Light has spent more money——

Mr. Waxman. No, no. I'm asking you a question. Is it accurate to say that Indiana emits more sulfur dioxide than any other State in the Nation except Ohio? Is that an accurate statement?

Mr. McKnight. That depends on the year and the time you're looking at it. Certainly, there are years when we did.

Mr. Waxman. How about this year at this time?

Mr. McKnight. I can't answer that right now.

Mr. Waxman. You haven't seen any information?

Mr. McKnight. Certainly, we are one of the highest emissions——

Mr. Waxman. It doesn't mean you're an insensitive polluter. It just means that the fact is that Indiana emits more sulfur dioxide than any other State in the Nation except Ohio. And, in fact, of the 26 million tons of sulfur dioxide emitted annually across the country, Indiana generates 2 million tons or approximately 7 percent of the emissions. Do you think that's an inaccurate statement?

Mr. McKnight. No, no.

Mr. Waxman. You do not think it's——

Mr. McKnight. No.

Mr. Waxman. Now, I was surprised, because your cost analysis estimates are based on 1993 dollars, isn't that correct?

Mr. McKnight. No, sir.

Mr. Waxman. They're not based on 1993 dollars?

Mr. McKnight. 1984 dollars.

Mr. Waxman. They're based on 1984 dollars?

Mr. McKnight. Yes, sir.

Mr. Waxman. The first page of your testimony says, "H.R. 3400 will cost IPL ratepayers $439 million in capital costs [1993]." What does that mean if you're not talking about 1993 dollars?

Mr. McKnight. The testimony that I—that is in error. That's 1984 dollars.

Mr. Waxman. That should be 1984 dollars?

Mr. McKnight. Yes, sir.

Mr. Waxman. Now, you've testified before the U.S. Senate; do you recall that?

Mr. McKnight. Yes, sir.

Mr. Waxman. And do you recall that in your testimony before the U.S. Senate you talked in terms of 1990 projected costs? Do you recall whether your figures at that time were based on 1990 dollars?

Mr. McKnight. I don't know what those were based upon.

These were based upon a new reassessment of the cost of these, based upon EPA—well, it wasn't based upon it. It was well within the range of EPA's estimated costs for FGD systems. Their recent release put the cost of FGD systems I believe it's between $100 and $280 a kilowatt. Those were based in terms of 1981 dollars adjusted. The cost of FGD systems we propose to install here would be approximately $206 a kilowatt. This is based upon engineering estimates which followed an engineering study.

Mr. WAXMAN. Well, let me just tell you why I asked that question, because you stated to the U.S. Senate—you were talking about costs there. You said:

> Unlike some of the other projects around that you have heard today, all of my dollars unless I state otherwise are in terms of 1990 dollars; cost projections made on 1981 dollars, when we made this estimate, were escalated to 1990, assuming that, one, we could not build FGD systems much faster than before 1990. In any case, that we would be talking in actuality 1990 dollars. These have been compared by the company to 1990 projected revenues.

So, your presentation there was admittedly 1990 dollars. Your statement here says estimate capital costs, in paren, (1993), so I'm just confused by looking at these statistics, both in your statement to the Senate and your statements to us, whether you're talking about those dollars today, dollars in 1990, or dollars for 1993.

Mr. MCKNIGHT. These are based upon 1984 dollars. The aggregate of the three units that we would put scrubbers on, the weighted average was $225 a kilowatt in 1984 dollars. This ranged from $225—or $218 to a little more than $270.

Mr. WAXMAN. I appreciate that clarification.

Dr. Ali, I'm really amazed at the numbers that you've given us. You know, in the last Congress, my subcommittee considered a cost-effective acid rain bill that said no subsidies to the Midwest, and the utilities came in and said they would put on scrubbers and electric rates would go up 40 percent, and they painted a very bad picture.

So, we listened, and this year we developed a bill that required scrubbers, that also required ratepayers from all around the country to chip in for the 90 percent of the cost, and now I find out that by doing this, the rate increase goes from 40 percent to 47 percent. I'm just glad we didn't provide for 100-percent reimbursement, because I imagine that the rate increase would jump up to 70 percent or even 80 percent.

I'm just quite astounded at these numbers. I'm interested in your numbers because they don't seem to reflect that powerplants all around the country have been installing scrubbers and have not received any subsidy, but their ratepayers have faced only moderate increases. In fact, if you look at TVA, which is our Nation's largest utility, over the last decade, they have made significant reductions without any subsidy, and the increases have been kept under 10 percent. I'm astounded. Also, in listening to your testimony and Mr. McKnight's, one would think that Indiana is one of the cleanest States and doesn't contribute to the problem.

You are aware that Indiana emits over 2 million tons of SO_2 each year, that it's the second dirtiest State, and its emissions have increased over the last decade, aren't you?

Mr. ALI. May I answer that question? Which one do you want me to answer first?

Mr. WAXMAN. Well, my question to you is are you aware that Indiana emits over 2 million tons of SO_2 each year, it's the second dirtiest State, and its emissions have increased over the last decade?

Mr. ALI. I'm aware that Indiana emits about 2 million tons or in that range.

I'm not aware of Indiana being the dirtiest State because we——

Mr. Waxman. Second.

Mr. Ali. Or the second dirtiest State, because we do comply with the existing environmental laws and standards, and those do not seem to reflect that Indiana is any dirtier than any other State.

Mr. Waxman. Of course, I'm not talking about morality. I'm talking about the amount of tonnage of SO_2.

You say you question the National Academy of Sciences study. Do you challenge the premise that SO_2 causes acid rain?

Mr. Ali. SO_2 serves, according to them, as a precursor of acid rain. It is not a direct relationship.

Mr. Waxman. It is not the what? I didn't hear you.

Mr. Ali. It is not a direct relationship.

Mr. Waxman. What else has to happen?

Mr. Ali. It has to convert. It has to transport.

Mr. Waxman. But if there were no SO_2, it wouldn't be transported? It wouldn't be the precursor that ends up as acid rain?

Mr. Ali. Acid rain could come from NO_x. That's why.

Mr. Waxman. You mention that the bill identifies powerplants as the only source of SO_2 emissions which must be controlled. Are you aware that the bill applies to industrial sources as well?

Mr. Ali. No, I'm not aware of that. I was looking at the OTA reductions, and——

Mr. Waxman. Well, I do want you to know that the State's share under phase II is not limited to utility plants, and so your testimony in that respect is incorrect.

Mr. Ali. It's implied in that, then, that State shares are to come from industrial sources as well?

Mr. Waxman. That's correct.

Mr. Ali. My understanding in the State of Indiana was that they will not necessarily follow the lines.

Mr. Waxman. You also indicate that the revenues raised under H.R. 3400 will not meet the capital requirements. I want to tell you that I'm prepared to insure that there will be adequate funding by indexing the fee to inflation if that's necessary. This will provide about $15 billion for phase II of the program.

I want to say to you again, and caution you, that I believe you've misstated the bill's effect, because CRS found that there clearly would be adequate funding if nonnuclear power grows at a rate of just 3 percent.

On page 14 of your testimony, you state that OTA estimated a 14 percent rate increase for Indiana under our bill. Again, I want to point out that OTA has told us that Indiana residential ratepayers would actually see a rate hike of about half of what you say. Although the financing is complex, OTA estimated a 1.6 percent in phase I; a 7.4- to 9.3-percent hike in phase II; and a 5.8- to 7.7-percent hike in Phase III.

We have been told by OTA that the phase II costs are more representative of this programs costs.

Do you have any thoughts on that?

Mr. Ali. OTA, in its July report, released average figures in Indiana which show about 14 percent. In September, those same figures went up. OTA's estimate of the impact and average rates in Indiana went up from 14 percent to close to 19 percent. I do not know if reduction's being shown by OTA.

Mr. WAXMAN. Do you agree that it's 14 percent and not 47 percent?

Mr. ALI. Let me explain the 47.9 percent. As the slide indicated and my charts show, it is with the condition if no funds from H.R. 3400 are available.

Mr. WAXMAN. If no funds are available?

Mr. ALI. That's right. And that premise is based on the statement that funds are being available on first-come, first-paid basis. Indiana, being not a CWIP State, will not benefit as readily as some of the other States.

In case of capital short-fall, there will be no funds available, so we have provided you with the estimate both ways, with the funds available and without the funds.

Mr. WAXMAN. Dr. Ali, have you read the bill?

Mr. ALI. Excuse me?

Mr. WAXMAN. Have you read our bill?

Mr. ALI. Yes, sir.

Mr. WAXMAN. The bill itself; not just the report?

Mr. ALI. I have read the bill.

Mr. WAXMAN. Well, we have a provision in there which I believe is clear and takes care of it. Of course, we'll be glad to go over that with you and make sure that the money will, in fact, be available, because that's our intention.

I just want to say Indiana is a major pollutant and contributor to the acid rain problem. Congress wants to deal with that problem. We propose that all the States chip in to pay for controls. Some States would do so reluctantly, but they understand the need to protect workers and consumers, and they're acting in good faith.

In fact, California, which is my home State, emits very little SO_2. In fact, Gibson Station here emits over 300,000 tons of SO_2, which is about four times the total emissions from the entire State of California. Now, the majority of members from California have cosponsored H.R. 3400, because, even though our State is not a major emitter, we share a responsibility in solving a national problem.

A majority of New York members, who represent, perhaps, the hardest hit State, are also acting in good faith and are willing to help pay for Indiana's controls.

But these members don't have unlimited patience. They want action now. If they perceive that the Midwest is not acting in good faith, they could insist on no subsidies when we legislate on the acid rain problem. And if legislation is enacted without subsidies, then Indiana consumers may really have something to fear.

I don't want this to happen. I'm going to work very hard to make sure protections for the Midwest are intact. But I want you to know that you're not making our job any easier. In the long run, it may be your rate payers, who don't dislike scrubbers the way utilities do, that will suffer.

I don't think you're reflecting your ratepayers when you present to us an attitude as if they didn't care about the problem and weren't willing to do anything about it.

Mr. ALI. If I may, Mr. Chairman.

Mr. WAXMAN. Sure.

Mr. Ali. I'm not a politician. I'm a professional. And it is my opinion that Indiana and Public Service Indiana is complying with all of the environmental laws. Indiana is not the dirtiest State.

Mr. Waxman. I'm not challenging that. I'm suggesting we need new laws if we're going to deal with the problem of acid rain.

Mr. Ali. And the reason Indiana is having higher emissions is because the Indiana air can accommodate higher emissions compared to some other States where pollution may be more severe.

Mr. Waxman. But isn't it true that you're exporting your garbage in the air to other States, and that's why we've got an acid rain problem?

Mr. Ali. Sir, that is the very reason I'm suggesting that there should be an acceleration of research to prove that point.

Mr. Waxman. I see. So, you dispute the very basic assumption of the National Academy of Sciences that I would just recite to you, and I'm reading from their report on page 3: "Although claims have been made that direct evidence linking powerplant emissions to the production of acid rain is inconclusive"—and they say "Poundstone, 1980, Curtis, undated" in parentheses—"we find the circumstantial evidence for their role overwhelming. Many thousands of lakes have already been affected, such as vulcanism, and the weathering of pyrites, or biological factors, such as acid bog drainage, cannot be implicated." But, again, they say, "Circumstantial evidence for their role is overwhelming." So, the National Academy of Sciences finds the evidence overwhelming, but you have doubts about it?

Mr. Ali. I'm not suggesting there is no problem with acid rain. I'm not suggesting that something should not be done. My suggestion is the National Academy of Science in 1983 says that controlling emissions in one geographic area will not result in benefits that one is looking for in another geographic area. That's the point I'm making, sir.

Mr. Sikorski. Mr. Chairman.

Mr. Waxman. Mr. Sikorski, I'm going to recognize you.

Mr. Sikorski. Mr. Ali, or Dr. Ali, they said that reductions across the board in emissions will produce reductions in acid rain, which will have the same kind of effect that those who argue that you should have point to point reductions, didn't they also?

Mr. Ali. Mr. Sikorski, what they are saying is that——

Mr. Sikorski. Didn't they also——

Mr. Ali. They said if you take an area large enough, a geographic area large enough, if you make 50-percent reductions, then it would reflect in the acidity of the area.

Mr. Sikorski. So, it's the lake that's going acid and dying because of acid rain; does it make a big difference if it's saved, just as long as we're equitable in the process?

Mr. Ali. My point is——

Mr. Sikorski. Are you arguing that we shouldn't reduce SO_2 emissions by 50 percent?

Mr. Ali. No. No, sir; I showed you the chart.

Mr. Sikorski. You agree that we should reduce emissions by 50 percent?

Mr. Ali. It should be reduced equitably if there is any correlation to show benefits.

Mr. SIKORSKI. But the National Academy of Sciences has said if you have 50-percent reduction, there will be a 50-percent reduction of the pollution, and there is a corollary of benefits. Are you disagreeing that the National Academy of Science has said there's no——

Mr. ALI. Taking a broad area, I would support that. When you confine it to a small geographic area, I would disagree.

Mr. SIKORSKI. Why are you confining it? I'm not confining it. Why are you confining it; just to beat down the bill or beat down legislation, or beat down the idea of doing something about it?

Mr. ALI. If I may answer, H.R. 3400 does not say all sources must reduce 50 percent.

Mr. SIKORSKI. Why are you confining it?

Mr. ALI. I'm pointing out what H.R. 3400 does not contain.

Mr. SIKORSKI. Why are you confining the National Academy of Sciences' conclusions to a specific point in a specific receptor?

Mr. ALI. I'm not.

Mr. SIKORSKI. Well, Mr. Chairman, may I?

Mr. WAXMAN. Yes; the gentleman's recognized.

Mr. SIKORSKI. Mr. McKnight and Dr. Ali, just as the other opponents, like to cite the National Academy of Sciences.

In fact, Mr. McKnight, I think you quote them once, twice, three, four, five times, and it's the only outside quote, the only scientific quotations in your statement here today, isn't that correct?

Mr. MCKNIGHT. Certainly; yes.

Mr. SIKORSKI. Well, they evidently have the competence and the integrity, and the objectivity, and the insights that are necessary if you're going to quote them at such length and restrict your quotes to them, evidently, is that correct?

Mr. MCKNIGHT. Yes.

Mr. SIKORSKI. But you restrict your—you support them to just those quotations or everything they've said?

Mr. MCKNIGHT. Many of the times they've been misconstrued. In a preface of that very report—I can even read that into the record if you care—the conclusions were misinterpreted in the press and by others. They cite Science magazine; Washington Post has a recommendation for 50-percent reduction in emissions.

Now, that is not what they said.

Mr. SIKORSKI. Why don't you read what they said.

Mr. MCKNIGHT. But the National Academy——

Mr. SIKORSKI. Mr. McKnight, why don't you read for the record what they did say?

Mr. MCKNIGHT. Fifty-percent reduction in emissions for pollution—emissions of pollutant gases, sulfur dioxide and nitrogen oxides, that are precursors of acid precipitation. While the report concluded that desired reduction in deposition of hydrogen ion implies a reduction in emissions, it did not indicate how much additional control of emissions would be required to meet that goal.

I'm looking at the preface IX; that'd be nine, Roman numeral nine.

Could I clarify, Congressman Waxman——

Mr. SIKORSKI. I want to finish this. You like to quote the National Academy of Sciences, and you will give them the authority, the integrity, the objectivity, the competence, and the data, when it confuses the issue. But you refuse to look at their conclusions. You refuse to look at what they've stated to the public and the decisionmakers with regards to acid rain.

Mr. McKNIGHT. I just read you what—what was interpreted as their conclusion was misrepresented or was misinterpreted.

Mr. SIKORSKI. The Chairman of the National Academy of Sciences in releasing this report, said simply, in stark terms, "Cutback in emissions cuts back in acid rain." In 50-percent reduction, it provides a 50-percent pollution reduction as well.

Mr. McKNIGHT. There was a marked number of newspaper articles by several scientists that participated in that that said that was not the conclusion of the commission itself, but of the chairman.

Mr. SIKORSKI. Well, let's look at the other part of the litany. We've heard that we don't know enough, and there's confusion among the scientists, except we don't see the scientists being confused. We've heard that jobs are going to be reduced, but we have the number of coal miners in Indiana going up in the bill. We have the coal production going up. We see what happens with electrical rates.

So, we're left with the argument you make.

Mr. McKNIGHT. Your interpretation of the electrical rates, or whoever those are, are not correct.

Mr. SIKORSKI. Well, let me cite the head of the Tennessee Valley Authority, David Freeman, quote:

> During the past six years, the Tennessee Valley Authority has completed the largest air pollution clean-up effort in American history, investing close to a billion dollars of its rate payers' money in cutting in half the sulfur dioxide emissions from its 12 coal-fired power plants. This effort has reduced TVA's sulfur dioxide emissions by over a million tons per year.

That's half of what you're putting out in Indiana:

> TVA consumers assumed the cost of this clean-up without Federal subsidy. Their bills did not double, or even go up by 50 percent, as some alarmists would have you believe. Over a six year period, TVA's rates increased a total of nine percent due to this clean-up effort.

Mr. McKNIGHT. TVA's proportion of their generation that is coal is a small proportion. When I talk about my company, we are burning 100 percent Indiana coal. TVA has hydro. TVA has nuclear.

Mr. SIKORSKI. Mr. McKnight. Mr. McKnight, don't—are you denying that they reduced——

Mr. McKNIGHT. If I had five nuclear plants and——

Mr. SIKORSKI. Are you denying that reduced 1 million tons of emission?

Mr. McKNIGHT. No; I'm not denying that.

Mr. SIKORSKI. Are you denying that they did it with less than a 10-percent rate increase?

Mr. McKNIGHT. They had——

Mr. SIKORSKI. Are you denying that they did it without Federal subsidy?

Mr. McKNIGHT. They had a 10-percent rate increase because——

Mr. SIKORSKI. You're denying that you won't do it. You are just denying the fact that you won't do it, won't even look at it, you want to continue going on the way you're doing?

Mr. McKnight. I'm trying to explain that they have a different generation mix than my company does. They had a generation mix that was composed of hydro, nuclear, and other nonemission or non-SO_2 emission things.

As you dilute that with the other nonsulfur emitting generation, you don't need a 10-percent rate increase.

Mr. Sikorski. Mr. McKnight, you must be confused. Let me read again Mr. Freeman's statement:

> * * * investing close to a billion dollars of its rate payers' money in cutting in half the sulfur dioxide emissions from its 12 coal-fired power plants.

We're not mixing apples and screwdrivers here. We're talking about——

Mr. McKnight. Ten-percent rate includes all their generation, not the rate or the cost from those 12 powerplants.

Mr. Sikorski. No, no, I'm sorry. You didn't—you didn't listen either. He goes on to say:

> Over a six year period, TVA's rates increased a total of nine percent due to this clean-up effort.

Mr. McKnight. That's right.

Mr. Sikorski. The coal-fired, sulfur dioxide reduction effort.

Mr. McKnight. Certainly, if I had 40 percent, or 60 percent of my generation was nuclear, and I have $1 million, or any number, and I divide that rate increase of cost—the cost of pollution control across all my generation——

Mr. Sikorski. He did not do that. Mr. Freeman did not do that, Mr. McKnight.

Mr. McKnight. Well, I——

Mr. Sikorski. He said it very clearly, and he didn't do it.

Mr. McKnight. I think you're misinterpreting what Mr. Freeman said. He was talking about a 10-percent rate increase. That rate composes the cost of generation of their fossil, their nuclear and their hydro.

Mr. Waxman. If the gentleman, will yield to me.

I happen to have a copy of the remarks by S. David Freeman, Director, Tennessee Valley Authority. This is before the Citizens Conference to Stop Acid Rain, Manchester, N.H., January 6, 1984, and I'm quoting now directly:

> During the past six years, TVA has concluded the largest air pollution clean-up effort in American history, investing close to a billion dollars of its rate payers' money in cutting in half the sulfur dioxide emissions from its 12 coal-fired power plants. This effort has reduced TVA's sulfur dioxide emissions by over a million tons per year.

Next paragraph:

> TVA consumers assumed the cost of this clean-up without Federal subsidy. Their bills did not double or even go up 50 percent as some alarmists would have you believe. Over a six year period, TVA's rates increased a total of nine percent due to this clean-up effort.

So, you're saying that that wasn't a cleanup for coal-fired plants even though he said so?

Mr. McKnight. That 10-percent increase included the dilution effect of their other nonfossil fuel generation; the nuclear, the hydro that they have.

I don't deny that they may have cleaned up 1 million tons of—and that they may have spent $1 billion. It's just that $1 billion spread across their total generation mix, yes, only raised rates by 10 percent. Had they had only the fossil fuel generation to rely upon, then their rates would have gone up more.

Mr. WAXMAN. The price of nuclear power is expensive. It's not cheap. Isn't that correct?

Mr. MCKNIGHT. And they did not include that. They said that the 10 percent was as a result of their fossil fuel——

Mr. WAXMAN. What 10 percent are you talking about? I didn't say 10 percent.

Mr. MCKNIGHT. Their 9- or 10-percent rate increase.

Their rates escalated 9 or 10 percent

Mr. WAXMAN. I don't know where you got the figure, 10 percent. It says:

> During the past six years, TVA's completed the largest air pollution clean-up effort in American history, investing close to a billion dollars of its rate payers' money cutting in half the sulfur dioxide emissions from its 12 coal-fired power plants.

Mr. SIKORSKI. Nine percent. Next paragraph down.

Mr. WAXMAN. Oh, I see:

> TVA's consumers assumed the cost of this clean-up, and their bills have not doubled. Over a six year period, TVA's rates increased a total of nine percent due to this clean-up effort.

Mr. MCKNIGHT. That's right. Their rate increased 9 percent due to that cleanup effort. That does not say what it costs them to shift to nuclear or what other alternate generation facilities.

Mr. WAXMAN. Well, we'll get a clarification from Mr. Freeman. I think that would be helpful for the record.

Mr. SIKORSKI. Mr. Chairman, I think that would be helpful.

Mr. WAXMAN. Without objection, we'll hold the record open to receive that additional fact.

Mr. SIKORSKI. I've just one question. It's just amazing, the obfuscation, and the attempt to delay, and, at the same time, destroy economic and environmental resources, and the public health in this country, by some, and it's not their money. Mr. McKnight, you said in your statement that your ratepayers insist that you take this position. "This is our position—it's a position that our customers and that we take."

Did you do a survey on your customers?

Mr. MCKNIGHT. No, sir.

Mr. SIKORSKI. Oh, it's something you know from osmosis?

Mr. MCKNIGHT. Certainly, our customers—it is not in our customers' interest to have any rate increase that is unjustified. We view this as being unjustified.

Mr. SIKORSKI. If I ask that question—if I asked your customers whether your salary was something they wanted to pay for, even if it was unjustified, how do you think I'd get back—what do you think I'd get back from that question?

Mr. MCKNIGHT. I think you would get an answer that no expenditure——

Mr. SIKORSKI. Well, at least, I'd ask them, huh?

Mr. MCKNIGHT. [continuing]. By a utility these days is justified.

Mr. SIKORSKI. At least, I'd ask them. You send out things. Why don't you ask them an objective question on acid rain? I think Louis Harris and others have.

Mr. Ali, if things go up in the air—2 million tons of SO_2 go up in the air in Indiana every year, where do you think it comes down? Or doesn't it? Where does it go?

Mr. ALI. Most effect would be within the 200 kilometers or so as the EPRI's program has indicated.

Mr. SIKORSKI. So, it comes down?

Mr. ALI. Of course, all of it comes down.

Mr. SIKORSKI. And most of it in Indiana; in what form?

Mr. ALI. Some of it is sulfur dioxide; some of it in wet form: some of it in dry form.

Mr. SIKORSKI. Acid deposition, right?

Mr. ALI. Not necessarily. Some of it will be in sulfate, combining with other particles, some acid depositions.

Mr. SIKORSKI. It goes 1,000 kilometers, according to the National Academy of Sciences, page 9.

But what have you people seen in terms of the effects on Indiana?

Mr. ALI. I'm not aware of any acid rain effects in Indiana.

Mr. SIKORSKI. No neurotic spotting? No leaf burning? No stunted growth of forests?

Mr. ALI. I've not heard of it.

Mr. SIKORSKI. No effect on fish fry at all? Soil microbes? Have you looked at soil microbes?

Mr. ALI. We have not looked at any. I'm going by what we have found out, and I have no——

Mr. SIKORSKI. What does the White House Office of Science and Technology say about soil microbes?

Mr. ALI. I don't know what they say.

Mr. SIKORSKI. Mr. McKnight.

Mr. MCKNIGHT. I'm not aware of—I'm aware that the damages that people like to claim are often drawn from the Crocker study, which was flawed in many areas. When they transplant this $5 billion cost, Crocker utilized ozone damage and somehow projected SO_2 damage from tests on ozone.

Crocker, in his own right, acknowledged that it was foolhardy to even make this estimate on $5 billion.

Mr. SIKORSKI. Let me make a refutation of the comment just made. I'll cite the study that's already been presented to the subcommittee released today by Dr.—is it Louchs—Ourie Louchs, director of Butler University, Holcomb Research Institute, in preparation of undertaking research for the EPA on foliage problems.

Mr. MCKNIGHT. Can I ask? Is this released just today?

Mr. SIKORSKI. Yes. How many of your ratepayers are rural people; agriculture? What's your agricultural base economy in Indiana; 15 percent, 20 percent, 25 percent?

Mr. MCKNIGHT. I can't speak to that, but Marion County is relatively small.

Mr. SIKORSKI. For your information, the White House scientists said that their greatest concern in terms of agriculture is the effect of acid due to acid rain; soil microbes, and those microbes are the basis of our whole organic life. They recharge the soil. They provide the basis from which organic growth is maintained. They know it's very sensitive and have real concerns about it.

And I would commend that to anyone in Indiana who's concerned about its agricultural economic base.

Mr. McKnight. The different—there's many areas in Indiana that we're putting ammonium sulfate on the ground because our soil is not acid enough. Certainly, we are looking at our soils. This is one of the things that we are developing in our Ebara project, and that is an ammonium sulfate fertilizer, which is what we need here.

Mr. Sikorski. Thank you, Mr. Chairman.

Thank you.

Mr. Waxman. Thank you, Mr. Sikorski.

Thank you, gentlemen, for your testimony, and for your participation in this hearing.

I wanted to indicate to you that Congressman Sharp is going to review the testimony. He had another meeting he had to attend, but he wanted me to make that comment to you.

We thank you for your participation. We thank everyone who has participated here today.

And we will hold the record open, because I know there are others who would like to insert additional information or testimony. We will hold the record open for 30 days. That concludes our meeting. We stand adjourned.

[Whereupon, at 3 p.m., the hearing was adjourned.]

[The following statements and letters were submitted for the hearing:]

PUBLIC
SERVICE
INDIANA

March 5, 1984
File No. A32.31

The Honorable Henry A. Waxman, Chairman
House Subcommittee on Health & the Environment
House Committee on Energy & Commerce
512 House Office Building, Annex 1
Washington, D.C. 20515

Dear Mr. Waxman:

On behalf of Public Service Indiana, I want to express my appreciation for the opportunity to testify on H.R. 3400 when your subcommittee held field hearings in Indianapolis last month. This legislation is important to our ratepayers and we believe that Congress must be aware of the broad economic impact it would have on much of the midwest.

During the hearing several issues were raised which I did not have the chance to discuss in proper detail. Therefore, I am submitting additional documentation and comments on these issues outlined in Appendix I and ask that they, along with this letter, be made a part of the official record of the Indianapolis hearings.

In addition, I want to express my disappointment and concern over the anti-utility bias which was obvious during certain parts of the February 10 hearing. Statements made by you and others on the subcommittee to the effect that utility data could not be trusted or believed, called into question the reasons why we were asked to testify in the first place. Mr. Chairman, we at PSI have worked hard to ensure that the cost data and other information on the effects of acid rain legislation be accurate and dependable. It is not our intent as a company and it certainly is not my intent as a professional scientist to conceal, distort or withhold information relating to the acid rain issue. While I recognize that we may have a different perspective on this issue, I would hope that in the future your subcommittee will resist the temptation to simply reject our arguments and our data out of hand. It seems to me the debate on acid rain must be carried out with a complete respect for all the facts.

Finally, while I commend you for holding hearings on H.R. 3400 in the midwest, I believe it would be useful to hold additional field hearings in California and other western states. If we are truly going to address this issue in a national sense, then their concerns must be considered.

Again, I appreciate the opportunity to share our views on acid rain. If you or your staff have additional questions, I would be pleased to respond.

Very truly yours,

S. A. Ali

S. A. Ali, Ph.D.
Executive Director
Environmental Programs

SAA:bb
Attachments
cc: Honorable P. Sharp
Honorable D. Coats
Honorable F. McClosky
Honorable L. Hamilton

APPENDIX I

ISSUE	TITLE	EXHIBIT
A	Detailed Rate Increase Analysis	A-1
B	Tennessee Valley Authority's Reduction Rate Impact	B-1
	The Cost of Acid Rain Control by A. Joseph Dowd (Dec. 5, 1983)	B-2
C	Are Midwest Utility Customers Willing To Pay For Acid Rain Control?	C-1
D	Public Service Indiana's Environmental Expenditure Summary	D-1
E	What Did the National Academy of Science Really Say?	E-1
F	Significant SO2 Emission Sources Ignored by H.R. 3400	F-1
G	Is Acid Rain Contaminating Drinking Water Supplies?	G-1
	"An Analysis of Potential Indirect Health Effects of Acid Rain Through Drinking Water" by Arthur D. Little, Inc. (June, 1983)	G-2
H	Acid Rain and the Indiana Melon Crop	H-1
	"Melon Damage in Southwestern Indiana 1983, Observations and Resulting Conclusions", Harris M. Bendict, PhD, (January, 1983).	H-2
I	American Lung Association of Indiana Testimony on H.R. 3400	I-1
J	Comments on Dr. Orie Louck's Testimony	J-1

EXHIBIT A-1

Detailed Rate Increase Analysis

In testimony given to this Subcommittee on February 10, 1984 we stated the rate impact on Public Service Indiana's customers, with 90% reimbursement of capital costs would be a 21% increase. Assuming no capital reimbursement, we stated the rate increase would be 47.9%. Since these increases differ significantly from those provided by even the upwardly revised versions of the Office of Technology Assessment (OTA) and other studies, we are providing the Subcommittee the assumptions and estimates used in determining these rate increases.

The bill H.R. 3400 would require construction of seven independent flue gas desulfurization (FGD) systems: four at the Gibson Generating Station, two at the Cayuga Generating Station and one at the Wabash River Generating Station.

Assumptions:

- Costs for scrubbers were based on the cost of our Gibson Unit #5 scrubber plus appropriate retrofit factors at each individual station. As indicated in our original testimony, these scrubber costs are within range predicted by all sources including EPA. No specific scrubber costs were identified in the OTA analysis of H.R. 3400.

- Reimbursement of the 90% capital costs (nominal dollars) would not be made until construction is complete and was assumed to be in 1990 dollars. This assumption emphasizes that Indiana does not allow Construction Work in Progress in the rate base.

  No reimbursement of Allowance for Funds Used During Construction (AFUDC) was assumed. The bill leaves such items to the discretion of the EPA Administrator.

- AFUDC was calculated during construction period at 12.0% compounded semi-annually.

- A 10% surcharge was assigned to all scrubbers required to be in operation as of January 1, 1990 to expedite construction schedule.

- Revenue requirement method was used to calculate rate increases based on 1982 revenues and zero growth scenario.

- A first year fixed charge rate of 25.3% was used. This reflected the company's cost of funds at July 1983 when the study was conducted.

- Increased production costs were determined by production simulation model.

- The operation and maintenance costs for scrubber operation were calculated at 3.5 mills/kwh plus a 7% increase in heat rate. These costs are conservative by industry standards. The Gibson Unit #5 scrubber would be upgraded from 1.2 lbs/million Btu to 0.6 lbs/million Btu under H.R. 3400.

Cost Analysis (1983 dollars):

Gibson Station 4 scrubbers	$ 556,853,000
Cayuga Station 2 scrubbers	256,740,000
Wabash River Station 1 scrubber	179,916,000
Gibson Unit #5 Upgrade	10,000,000
Total Construction Expenses	1,003,509,000
AFUDC	114,513,000
Total Capital Cost	$1,118,022,000
Total Capital Reimbursement[1]	855,337,000
Residual Capital Requirement	$ 262,685,000

First Year Revenue Requirement:

	With 90% Reimbursement	With No Reimbursement
Capital Component:		
$262,685,000 x 25.3%	$ 66,459,000	
$1,118,022,000 x 25.3%		$282,860,000
Additional Production Costs	89,427,000	89,427,000
Fee (1 mill/kwh generated)	15,116,000	15,116,000
Total First Year Revenue Requirement	$171,002,000	$387,403,000
Current (1982 Revenues)	$809,400,000	$809,400,000
Required Rate Increase	21.1%	47.9%

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[1] Capital reimbursement was calculated as 90% of nominal construction expenses (excluding AFUDC) in 1990 dollars brought back to 1983 dollars.

EXHIBIT B-1

Tennessee Valley Authority's Reduction Rate Impact

During the H.R. 3400 hearing in Indianapolis, the issue of a nominal rate increase by Tennessee Valley Authority (TVA), based on its recent experience in reducing SO2 emissions was made a part of the record. Subcommittee members quoted a 9% rate increase. Key differences between the rate increase analysis by Public Service Indiana and the TVA are identified here for the Chairman. These differences must be made a part of the record.

- TVA's reductions were made from a very high emission baseline of 5.95 pounds per million Btu, in 1974. The reductions were needed to bring the TVA into compliance with the Clean Air Act. Reductions from this high baseline are less costly than reductions from systems already in compliance, such as PSI.

- A major proportion of the TVA SO2 emission reduction was made by switching to low sulfur coal. This relatively low cost method probably will not be available to Midwest utilities under acid rain legislation due to political considerations and increased demand.

- A part of the TVA SO2 emission reduction was not actually a reduction in emission rates, rather the replacement of fossil-fired generation with nuclear. TVA placed in service 2440 MW of non-SO2-emitting nuclear capacity. This base-loaded nuclear capacity displaced a significant amount of TVA coal fired generation with no addition to TVA's SO2 emission reduction costs.

- In 1982, TVA had 45% non-SO2-emitting nuclear and hydro generating capacity. Since the nuclear plants are the newest, an even larger portion of TVA's rate base represents non-coal fired capacity. Hence TVA was able to spread the SO2 reduction costs over a much greater rate base with the resultant lower rate increase due to the SO2 emission reductions.

- The rate increase quoted for TVA's SO2 emission reduction is spread over its total generating capacity and cost. Each kilowatt hour of nuclear and hydro generation lowers the cost and rate of compliance.

In a presentation before the Coalition of Northeastern Governors Conference on December 5, 1983, A. Joseph Dowd, Senior Vice President and General Counsel of American Electric Power addressed this issue in more detail. We have enclosed a copy of his address and ask that it also be made a part of the record of H.R. 3400 hearing.

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EXHIBIT B-2

THE COST OF ACID RAIN CONTROL

By

A. Joseph Dowd
Senior Vice President and General Counsel
American Electric Power Service Corporation
Columbus, Ohio

Before the
Coalition of Northeastern Governors Conference
December 5, 1983

Governors, Ladies and Gentlemen: My name is Joseph Dowd. I am Senior Vice President and General Counsel of American Electric Power, which is a large midwestern coal-burning electric utility system of the type which many of you may view -- rightly or wrongly -- as a major culprit in the acid rain scenario. I appreciate the opportunity to represent the Edison Electric Institute before the Coalition of Northeastern Governors this morning.

Since I have been asked to confine my remarks to cost impacts, I will reluctantly forego the temptation to discuss the compelling scientific uncertainties that surround almost every facet of the acid rain issue. Suffice it to say that the present state of the science is such that nobody can predict with any reasonable degree of assurance whether a massive reduction in SO_2 emissions in the Midwest will produce even perceptible ecological benefits in the Northeast or in Canada. One aspect of this uncertainty was highlighted in the recent National Academy of Sciences report which repeatedly stated that the relative influence of long-range versus local emission sources is still unknown. Another major uncertainty is the extent to which acidity from terrestrial factors, rather than from atmospheric deposition, is responsible for whatever aquatic damage may be occurring. While this audience might prefer not to hear about these scientific uncertainties, you should be aware that they are becoming increasingly obvious and must be of controlling importance in any legislative resolution of this issue.

And now for costs!

In 1981 and 1982 a variety of groups commissioned macroeconomic analyses in an effort to gauge the impacts that would result from the imposition of a 10 million ton SO_2 reduction. Even though most of the studies were made by the same consultant, ICF, Inc., the results vary widely because different clients specified different assumptions.

At the lower end of the the spectrum, ICF predicted for several national environmental groups that a hypothetical 10 million ton reduction would trigger capital cost requirements of $14.7 billion and annualized costs of $2.8 billion. It was assumed that cost-free interstate trading of SO_2 reduction credits would be maximized and that emission increases resulting from future economic growth would not have to be offset.

In a study conducted for the Edison Electric Institute (EEI), ICF projected that the 10 million ton reduction program proposed by Senator Mitchell would impose capital costs of $26.2 billion, annual costs of $6.9 billion, and would result in an average electric rate increase across the 31-state ARMS region of 6.1 percent, but with much higher increases occurring in the Midwest. Interstate trading was not assumed, in view of its dubious potential, and, as specified in the Mitchell bill, emission offsets were required.

Using its own macroeconomic analytical approach, the Department of Energy independently predicted that the annual cost of a 10 million ton SO_2 reduction would range from $2 to $6 billion in 1980 dollars. That comes to $200-$300 billion over a thirty year period.

More recently, at EEI's request the consulting firm of Temple, Barker and Sloane examined the costs likely to be imposed by H.R. 3400, the Waxman/Sikorski bill. That bill would require a 10 million ton reduction in SO_2 emissions, with a proviso that roughly two-thirds of the rollback be achieved through scrubbing. It was estimated that the levelized cost of compliance would amount to $7.9 billion annually ($1985), and that the total price tag through 2008 (including inflation) would be $222 billion.

One can raise questions -- indeed almost everybody has -- about each of the macroeconomic analyses. But they all have one thing in common: they all project multi-billion dollar annual costs.

While macroeconomic models serve a useful purpose in providing a broad brush, first cut approach to complex problems, our industry was concerned that, because such models generally assume a frictionless environment in which all opportunities are totally maximized, they tended to underpredict substantially the true cost of these various control scenarios. Also, the macro models cannot take into account the multiplicity of site specific factors, such as space limitations, plant age, boiler design, fuel supply, the relocation of existing systems, the difficulty of disposing of scrubber sludge, etc., which must inevitably have the effect of pushing costs well above those that the macroeconomic models would predict.

It was because of these concerns that earlier this year 24 electric utilities, under the auspices of the Edison Electric Institute and with the guidance of an independent economic consulting organization, embarked upon company-specific studies of the cost impact of the Stafford bill (S. 768). The Stafford bill was chosen because it is the only acid rain control bill ever to be reported out of committee and because it appeared to be the least Draconian of the pending bills in the sense that it calls for an eight, rather than a ten or a twelve million ton SO_2 reduction, and provides compliance deadlines of 1992 and 1995 rather than 1990.

The projected compliance costs reported by the individual utilities in this study predicted that the first year annual cost of achieving their share, which in the aggregate was approximately 44%, of the eight million ton SO_2 reduction would exceed $5 billion, and that five year levelized costs would exceed $4 billion annually, with capital costs being in excess of $15 billion. More than one-third of the companies indicated that first year rate increases in electric rates would exceed 20% and that (on a levelized basis) increases over five years would exceed 15% annually. Companies in Ohio and Indiana would be hit harder than others, with first year increases at about 50% and increases levelized over the first five years at about 35%.

We are aware that these industry cost estimates have been criticized as being too high -- even as being deliberately exaggerated. I would like to address these criticisms.

First, it is alleged that the use of first year costs is misleading because the cost gradually declines after the first year. There is a term that is currently in vogue. It is "rate shock". You've all heard of "rate shock" and many of you in this room have used that term. Well, first-year costs _will_ result in "rate shock" to our customers. They have a right to know it and we have an obligation to tell them of it. Yes, the costs do gradually decline after the first year and that is why we took the alternative approach of levelizing our cost figures over the first five years of compliance.

A second and related criticism is that in replacing prematurely retired plants, we included the total cost of the replacement plants in our studies even though such plants would in the natural course of events have gone on line a few years later. The fact of the matter is that if new, high cost plants go on line earlier than they otherwise would have, the _total_ annual costs associated with that expensive replacement capacity would in fact be incurred in those early years and should, therefore, be reflected in our studies.

A third criticism is that since the electric utility industry generally is in an "excess capacity" situation today, generating capacity lost as a result of acid rain controls does not have to be replaced and, therefore, emission reductions affected in this manner are "cost-free". This, of course, is absurd. First of all, don't be too sure about the "excess capacity". It may prove illusory. For example, last summer due to the heat wave three companies of the American Electric Power System established new summer peaks and a fourth established an all-time peak. Also, emission reductions effected through premature plant retirements by definition cannot be "cost-free". The mere fact that such retirements are premature means that those plants would have been serving load into the future had it not been for the imposition of acid rain controls. That load must then either be carried by new, higher cost replacement capacity or it must be shifted to more expensive existing capacity. In either case a cost obviously is incurred. In addition, the retrofitting of scrubbers onto existing power plants will effectively reduce the generating capacity of those plants. Approximately 5% of the electricity generated by a power plant is consumed in the operation of its scrubbers. Furthermore, because of the addition of this highly complex piece of chemical equipment -- with its potential for periodic breakdown -- the power plant's availability is reduced by as much as four to five percent. Thus, by way of illustration, today we have a hypothetical 1,000 megawatt generating unit. Tonight we retrofit it with a scrubber. Tomorrow morning we have what is effectively a 900 megawatt unit. Regardless of the so-called "excess capacity" situation, no one can tell me that there is not an economic cost to society involved in the loss of this 100 megawatts of good generating capacity.

The industry's numbers also have been criticized on the ground that we have adopted a high cost scrubber retrofit scenario rather than a least cost fuel-switching scenario in order to overstate the costs. Our response is that to the extent that scrubber retrofits were employed in our studies, this was done not to jack up the study costs, but rather because we believed that that is what we would ultimately be required to do. Those utilities located in the higher sulfur coal regions of Appalachia and the Midwest are convinced that as a practical political matter they would never be permitted to switch *en masse* away from their local coal supply. This view is reinforced by the fact that §125 of the Clean Air Act -- the so-called "Metzenbaum Amendment" -- is still on the books and, presumably, would be invoked in an effort to prevent the severe economic hardship and human suffering that would inevitably result from *en masse* fuel switching.

So we are back to a high cost scrubber strategy -- not out of choice, but out of necessity as we see it. One reason for the high cost is that scrubber retrofits would be confined to the *older* existing plants. It makes no sense to backfit new source performance standard (NSPS) plants since they are already meeting a very low 1.2 lb emission limitation. Therefore, only pre-NSPS plants would be retrofitted, i.e., those the construction of which had commenced prior to mid-1971. Under Senator Stafford's bill, 1993 is the year by which emission reductions accomplished through scrubber retrofits must be achieved. Thus, we are talking about retrofitting plants *the youngest of which would be about 20 years old* by the time its scrubbers go into operation. Don't we need to stand back and ask ourselves "Does it really make sense to backfit these older plants with scrubbers?"

Next, I'd like to discuss the TVA experience which has been misused by some in an effort to undermine the credibility of our cost studies. I've grown weary of hearing about the TVA costs and I want to meet them head on today.

TVA -- admittedly a great electric utility system -- says that it has reduced its SO_2 emissions by one million tons since the mid-1970's at a capital cost of about $750 million, resulting in a rate increase of only about 7%. Why then are our numbers so high?

First of all -- and this is not generally understood -- TVA's reductions were made from a very high baseline. In 1974 its system-wide average SO_2 emission rate was about 6 lbs. per million Btu (5.95 lbs. to be exact). Now this, ladies and gentlemen, is one heck of a high emissions level. By way of comparison, the American Electric Power System (my company) had in 1974 a system-wide average SO_2 emission rate of 4.05 lbs. which it has subsequently reduced to about 3.7 lbs. Now you know and I know that it is a lot easier and a lot less expensive to cut a million tons from a 6 lb. level than it is from a 3.7 lb. level. This then, is one very major reason why TVA's costs were so low -- most simply put, its emissions were very high.

Second, in carrying out its emission reduction program, TVA was in a position to place very heavy emphasis upon switching to low sulfur coal -- a low cost strategy which, as I indicated earlier, is probably unavailable to those utilities in the Midwest that would have to bear the brunt of proposed acid rain controls. This is another reason why TVA shows lower costs.

Third, a certain portion of TVA's net reductions resulted, in the natural course, from the preplanned construction of non-fossil-fired capacity. Thus, during the period subsequent to the mid-1970's, TVA placed in service 2440 megawatts of non-SO_2-emitting nuclear capacity. This base-loaded nuclear capacity displaced a significant chunk of TVA's coal fired generation -- but its cost, quite properly, was not included in TVA's SO_2 emission reduction figures. That is another reason why they are low.

A fourth reason relates to TVA's generation mix. It has a much heavier component of nuclear and hydro capacity than do the midwestern utilities. Thus, in 1982 TVA was only 55% coal. Contrast this with the slightly smaller AEP System (22,000 Mw versus TVA's 29,000 Mw) which in 1982 was 87% coal-fired. TVA, therefore, was able to spread its SO_2 emission reduction costs thinly over its total generation mix, 45% of which was totally unaffected by emission reductions. Another way of expressing it is that TVA's nuclear and hydro generated kilowatt hours (Kwh) had the effect of greatly diluting the cost per Kwh of its SO_2 emission reduction program and helps to explain why the resulting rate increase was as low as TVA claims.

Finally, we read that TVA views the future imposition of an 8 million ton acid rain control requirement, after the fashion of the Stafford bill, with equanimity and projects a resulting rise in electric rates on its system of only 3-6%. We, too, would view such prospect with equanimity if, like TVA, we were scheduled to bring on line about 5,000 Mw of non-SO_2-emitting nuclear capacity later in this decade.

My point is that the TVA experience has only the most limited relevance to the present debate regarding acid rain control costs. There are basic differences, which I have tried to explain. Once these differences are understood, the inapplicability of the TVA experience becomes evident.

In closing, let me say that the cost is going to be great no matter how you cut it. And whether you concentrate the misery in one already depressed geographic region or spread it thinly over 31 or 48 states, the cost to our nation will be the same. Are you so certain that commensurate or even perceptible benefits will result, that you are willing to impose these awesome costs upon the American Public! I urge you to get a better feel for what the benefits might be before you act.

Thank you.

EXHIBIT C-1

Are Midwest Utility Customers Willing to Pay for Acid Rain Control?

During a customers' attitude survey conducted for Public Service Indiana by Louis Harris in August, 1982, 74% of those surveyed indicated that they had even heard of acid rain. Those favoring legislation to reduce acid rain were 43.6%. However, when linked to a 20% rate hike, only 23.8% or less than one in four favored an acid rain bill. If the rate hike was 50%, only 7% or one out of 14 favored acid rain legislation. This study was designed to represent Public Service Indiana's customers attitude and is accurate to within 4%.

In a similar survey conducted for Union Electric Company by Cambridge Reports, Inc. in March, 1983, registered voters in the state of Missouri were surveyed. When no costs were related to acid rain control proposals, 62% indicated they favored the legislation. At any cost over $5 per month, only 21% favored legislation. When the costs were expected to go over $20 per month, only 3% of the registered voters indicated they would support such legislation.

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EXHIBIT D-1

Public Service Indiana's Environmental Expenditure Summary

During the February 10, 1984 hearing on H.R. 3400, utilities were accused by the Chairman of having little concern for the environment. Over the last several years, Public Service Indiana alone has spent about $200 million for environmental concerns. Over 90% of this amount has been to meet the requirements of the Clean Air Act. For example, about $64 million has been spent on electrostatic precipitators and an additional $91 million was spent on Gibson Unit #5 (676 MW) to meet New Source Performance Standards.

Expenditures of this magnitude do reflect a genuine concern for legitimate environmental issues. PSI has demonstrated its intention to comply with environmental laws and regulations. The National Ambient Air Quality Standards as established by the Clean Air Act is the proper place to address all human health issues and has the full support of PSI.

EXHIBIT E-1

What did the National Academy of Science really say?

During the February 10, 1984 hearing Congressman Sikorski frequently quoted the National Academy of Sciences (NAS) Reports (1981 and 1983) as recommending a 50% reduction in SO_2 emissions. He further applied this 50% reduction rationale indiscriminately to large utility sources scattered predominantly over the midwest. This interpretation and application by Congressman Sikorski is clearly in error when the actual text of the 1981 and 1983 NAS reports are reviewed. The 1981 NAS report discusses the protection of sensitive freshwater ecosystems on P.181. To protect those sensitive freshwater ecosystems it states:

> "In the most seriously affect areas (average precipitation pH of 4.1 to 4.2), this would mean a reductionof 50 percent in the deposited hydrogen ions".

The above quotation is not, as Congressman Sikorski stated, a recommendation for a 50% reduction in SO_2 emissions. Further, the NAS statement is not a categorical requirement for a 50% reduction in hydrogen ion deposition. The report suggests that reduction level only in sensitive areas. Jack Calvert, Chairman of the Committee on Atmospheric Transport and Chemical Transformation in Acid Precipitation, also clarified this point in the Preface (P.ix) of the 1983 NAS. He stated:

> "The conclusion was misinterpreted in the press and by others (see, for example, Science 214:38 October 2, 1981, and page A26 of The Washington Post for October 16, 1982 as a recommendation for a 50 percent reduction in emissions of the pollutant gases, sulfur dioxide and the oxides of nitrogen, that are precursors to acid precipitation".

It would appear that Congressman Sikorski fell into the same trap as others did.

The NAS in summarizing their findings did address the uncertainties in applying emission reduction strategies in the summary section of Implications for Emission Control Strategies. On page 11 of the 1983 NAS report it stated:

> "Because we cannot rely on current models or analyses of air-mass trajectories, we cannot objectively predict the consequences for deposition in ecologically sensitive areas of changing the spatial pattern of emissions in eastern North America, such as by reducing emissions in one area by a larger percentage than in other areas".

This statement by the NAS makes H.R. 3400 scientifically unsupportable as a mechanism to provide reductions in hydrogen ion deposition in ecologically sensitive areas. Because of lacking scientific basis, the indiscriminate emission reduction rationale of H.R. 3400 is inappropriate and unsupportable. The lack of scientific support is best summarized by Volker A. Mohnen, member of the authoring committee of the 1983 NAS report. He states in a letter to the editor in the August 8, 1983 issue of the The Wall Street Journal:

> "The bills pending in Congress require the largest reductions in emissions to come from sources in the Midwest, with much smaller reductions in the Northeast itself. The Academy's report specifically states that source-receptor relationship for this strategy cannot be established at this time. It thus does not provide scientific support for pending legislation".

SCS
3/5/84

EXHIBIT F-1

Significant SO2 Emission Sources Ignored by H.R. 3400

H.R. 3400 assigns SO2 emission reductions to the states based upon utility SO2 emission levels only. This mechanism completely ignores states with large non-utility SO2 emissions. This places an additional unjustified burden upon states with SO2 emissions predominantly from utilities. Two examples of this are Arizona and Texas. In 1980 the U.S. - Canada Transboundary Air Pollution Coordinating Committee reported statewide total SO2 emissions for Texas at 1,216,600 tons and for Arizona at 880,000 tons. According to OTA, Texas had 302,700 tons of SO2 emission and Arizona had 87,500 tons of SO2 emission from utility sources in 1980. H.R. 3400 would require an 11,700 ton reduction in Texas or 3.9% and no reduction at all in Arizona. Thus the two states with a total of 2,096,600 tons of SO2 emissions in 1980 would be required, per H.R. 3400 only an 11,700 ton reduction. In comparison, Indiana's 1980 total SO2 emissions of 2,063,600 tons would be reduced by 1,170,000 tons per H.R. 3400. The gross inequity of H.R. 3400 becomes obvious from this one example above. This identifies just one more shortcoming of H.R. 3400, the unjustified allotment of SO2 emission based on utility emissions and ignoring other significant emission sources.

SCS
3/5/84

EXHIBIT G-1

Is Acid Rain Contaminating Drinking Water Supplies?

Congressman Gerry Sikorski (Mn) noted during the H.R. 3400 hearing that acid rain is contaminating drinking water supplies. We have enclosed a report by Arthur D. Little, Inc. "An Analysis of Potential Indirect Health Effects of Acid Rain Through Drinking Water" which provides a scientific response to this emotional issue. A. D. Little has been performing such studies for EPA and industry. Their report concludes that " . . there is insufficient evidence to support a conclusion that acid rain produces or contributes significantly to adverse health effects by the indirect route of mobilizing lead, aluminum, cadmium, or asbestos in drinking water". The major pathways for ingestion of these contaminants by humans is via food not drinking water.

EXHIBIT G-2

Report to
Peabody Coal Company
June 1983

An Analysis of Potential Indirect Health Effects of Acid Rain Through Drinking Water

Arthur D. Little, Inc. *Reference 88996*

EXECUTIVE SUMMARY

In the national debate over the acidic deposition phenomenon ("acid rain"), some attention has recently been directed toward potential indirect human health effects. Limited draft reviews prepared by the Office of Technology Assessment (1982) and for the Environmental Protection Agency through the North Carolina State University Acid Precipitation Program (1982) have suggested that acid rain may mobilize certain toxic materials that indirectly affect human health by one of several pathways: through drinking water, through the food chain, or via special contact with acidic water, such as dialysis in the treatment of kidney disease.

At the request of Peabody Coal Company, Arthur D. Little, Inc., has examined this issue, focusing on the drinking water pathway and the contaminants lead, aluminum, cadmium, and asbestos. An analysis of the above-mentioned draft reviews, the principal literature cited in those reviews, and other sources of information has resulted in the following basic finding:

- At the present time, there is insufficient evidence to support a conclusion that acid rain produces or contributes significantly to adverse health effects by the indirect route of mobilizing lead, aluminum, cadmium, or asbestos in drinking water. There is no information on the incremental contribution of acid rain (i.e., the effect over and above what would occur without acid rain) to the concentrations of the studied contaminants in drinking water. Likewise, there is no good evidence as to the population at risk or the magnitude of the risk, including the incremental effect of exposure to the contaminants through the drinking water pathway relative to other sources of exposure.

This basic finding is supported by the following more specific findings:

- The sequence of natural and man-made events that occurs between the original precipitation and human consumption of drinking water is very complex and, in most cases, is likely to alter the quality of the water. Such natural physiochemical processes as contact with other substances accumulated on vegetation, reaction with decaying organic material, reaction with soils and rock strata, and dilution and interaction with aquifers or surface waters affect the quality of rainfall. Man further changes the water quality by such treatment processes as neutralization, clarification, carbon absorption, chlorination, and fluoridation. An examination of this complex pathway suggests that for most people in the United States, there is likely to be little or no relationship between the quality of their tap water and the acidity of the rain which is its original source.

- There is a segment of the population whose drinking water is likely to bear a more discernible relationship to the quality of the source precipitation--principally those whose drinking water is provided by domestic wells in unbuffered watersheds, or by cisterns fed by rooftop rainwater collection. As an approximate upper bound, this segment potentially "at risk" is estimated to be about 0.5% of the United States population.

- For these individuals, as well as for other potentially affected persons, the relevant studies provide no basis for determining what fraction, if any, of the reported concentrations of contaminants in their drinking water is attributable to acid rain as opposed to other causes. Any inferences that acid rain is the cause or even a contributing factor in elevated levels of the contaminants are ultimately based on the theory that if water is more acidic, it will be more corrosive. In fact, the relationship is far more complex and only imperfectly understood.

- Even natural or "pristine" rain (i.e., without contamination from acidic deposition) is known to be relatively corrosive. Hence, the passage of pure rainfall to drinking water supplies in unbuffered watersheds is likely to mobilize the studied contaminants. The incremental contribution of acid rain to the corrosivity of these water supplies has not been determined yet, and this is a critical piece of missing evidence.

- The drinking water pathway is not, in general, a major route of exposure to the studied contaminants in humans. Food is by far a more important source of exposure to lead, aluminum, and cadmium, and there is not enough information to suggest the principal exposure route for asbestos in the general population. More information is also needed on the relative importance of the drinking water pathway for individuals in particular subgroups of concern. There is at present no evidence that incremental levels of the contaminants caused by acid rain have any significant effect on human health through the drinking water pathway.

- The potential health effects that may result from increased levels of the contaminants in drinking water can be mitigated through compliance with applicable drinking water regulations and through replacement of lead-containing pipes or neutralization of source water in areas with naturally soft acidic water (such as the Adirondacks).

The substantial information gaps and uncertainties apparent in the current state of understanding of this issue could be addressed by the following research efforts:

- The incremental contribution of acid rain to concentrations of studied contaminants could be assessed by measuring the quality of tap water in homes serviced by lead, copper, or asbestos cement piping in areas of the U.S. with similar soils and geology but dissimilar acidic deposition (e.g., the Adirondacks vs. the Pacific Northwest).

- The corrosion of various types of materials could be evaluated in controlled laboratory experiments under conditions that simulate natural patterns of water use and key independent variables, such as alkalinity, total solids, and dissolved oxygen. These data could be used to help predict incremental concentrations of contaminants resulting from acid rain.

- Once estimates of the incremental contribution of acid rain to concentrations of the studied contaminants in drinking water can be made and data have been collected on the numbers of persons exposed to defined levels of total and incremental contaminant concentrations, a comprehensive risk assessment could be performed. This would place in perspective any incremental human health burdens attributable to acid rain via the drinking water pathway.

I. INTRODUCTION

In the national debate over the acidic deposition phenomenon ("acid rain"), some attention has recently been directed toward potential indirect human health effects. Limited reviews contained in a draft report prepared by the Congressional Office of Technology Assessment (OTA Draft, July 1982) and in a draft Critical Assessment Document prepared for the Environmental Protection Agency through the North Carolina State University Acid Precipitation Program (NCSU Draft, October 1982) have suggested that acid rain may mobilize certain toxic materials that indirectly affect human health by one of several pathways: through drinking water, through the food chain, or via special contact with acidic water, such as dialysis in the treatment of kidney disease.

Peabody Coal Company retained Arthur D. Little, Inc., to study this issue, focusing on one pathway, namely contamination of drinking water via dissolution of toxic materials (the Pathway), and on four materials, asbestos, cadmium, aluminum and lead (the Contaminants) believed to be the most important for the Pathway. The purpose of this work was to identify and analyze the key factors in the assumed sequence of scientific events related to this suggested problem and to recommend needed areas of additional research.

II. ANALYSIS

The suggestion that acid rain leads to indirect health effects through the drinking water Pathway is based on the theory that acid rain mobilizes certain metals and asbestos in drinking water supplies and that, when such water is drunk, those Contaminants produce adverse health effects. A critical concern in this issue is the incremental effect of acid rain through this Pathway--i.e., the effect over and above what would occur in the absence of acid rain. There are two aspects of the issue where incremental effects are important: (1) the incremental contribution of acid rain to the mobilization of the Contaminants in drinking water supplies; and (2) the incremental effect of such Contaminants attributable to acid rain in drinking water on the total intake and health of exposed individuals relative to other sources of exposure. In trying to develop a perspective on the first effect, the physical-chemical processes that are an integral part of the Pathway need to be understood. As to the second effect, it is necessary to understand the toxicology of the Contaminants ingested via drinking water, including the relative importance of that Pathway. These factors are now analyzed in turn, and a critical analysis of the principal relevant studies cited in the OTA and NCSU draft reports is presented.

A. Pathway Complexities

The quality of rainfall is altered by many chemical processes as it moves through watersheds, water treatment and distribution systems, and on to household taps. These processes are depicted schematically in Figure 1. Each box represents a chemical process which can alter the quality of the water flowing through it. The width of an arrow linking boxes approximates the volume of water transported via that route. The volume of water flowing through natural parts of the system (boxes 1-7) is generally much greater than the "man made" parts of the system (8-14), so arrow widths above box 7 should not be compared with arrow widths below box 7.

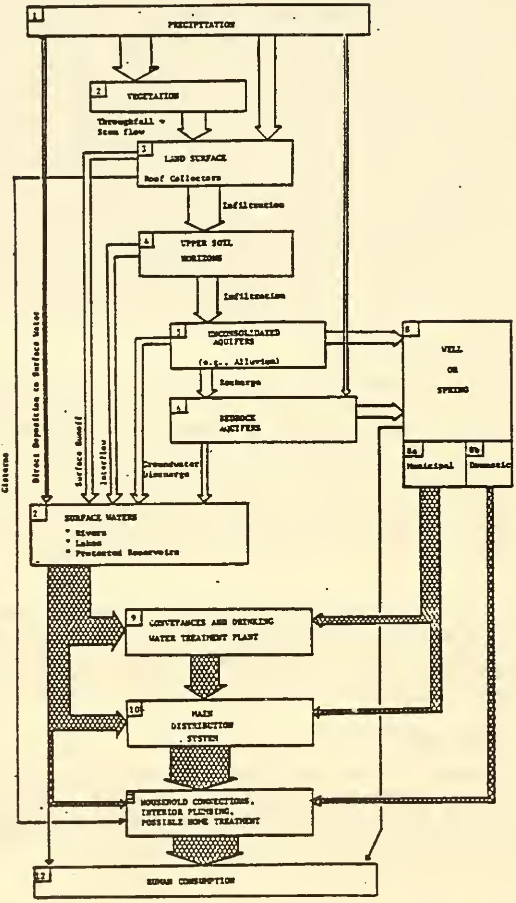
Figure 1 is a simplified representation of a system which is exceedingly complex. This analysis will summarize some of the physical and chemical phenomena which influence water quality in the system, but it is not meant to be comprehensive, as more detailed treatments are available (Drablos and Tollan, 1980; Nriagu, 1978; Dochinger and Seliga, 1976).

- Compartment 1

The atmosphere is the source of acidic deposition. Deposition rates are strongly time and location dependent. Sulfate and nitrate are generally agreed to be the major contributors to acidity in impacted regions such as the northeastern U.S. The deposition of neutralizing cations such as calcium and magnesium is also quite variable.

FIGURE 1

SCHEMATIC ILLUSTRATION OF DRINKING WATER PATHWAY(1)



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(1) The relative widths of the arrows above Compartment 7 denote comparative volumes. Likewise, the arrow widths below Compartment 7 denote relative volumes, but of a magnitude substantially less than those above Compartment 7.

- Compartment 2

Vegetative surfaces generate and accumulate a variety of Contaminants which interact with the rain to change its quality. Throughfall (water dripping from plant surface to the ground) and stemflow (water running along the plant stem) are generally much different in quality from the precipitation which generates them. Evaporation from plant surfaces may concentrate Contaminants. The rate of rainfall is an important variable affecting the impact of this compartment.

- Compartment 3

Paved, frozen, and other impervious surfaces do not permit infiltration. By and large, except for pavement, impervious surfaces have a small effect on the acidity of rainwater in comparison with other compartments of the Pathway because they act only as a collector and causeway. For example, precipitation on frozen ground passes quickly to surface waters with relatively little chemical alteration, a circumstance under which streams and lakes can be directly affected by any acidity in the rainfall. Rooftop collection of rainwater which is then stored in cisterns for subsequent domestic use is a rare practice in the continental U.S., though common in the U.S. Virgin Islands. Runoff from paved areas is usually quite contaminated as a result of rinsing off a variety of deposited pollutants, including lead from auto exhaust and asbestos from brake linings.

- Compartment 4

Surficial soil horizons are typically rich in decaying organic material. The soil water, particularly in forested soils of the northeastern U.S., may be more acidic than precipitation, but well buffered against further pH changes. Agricultural soils, on the other hand, are typically amended with lime or nitrogen fertilizers which dominate any effect of acid precipitation (McFee, et al., 1977). Soils over large portions of the Upper Midwest, Great Plains, Rocky Mountain, and Southwestern states are alkaline and substantially neutralize acid rain. Thus the quality of water which infiltrates slowly through soils will be substantially altered in this compartment, and in many locations its acidity will be neutralized.

During the infiltration process, metal and other cations may be mobilized. Intensive research has been focused on the mobilization of aluminum, a common element in many minerals, and it has been determined that significant amounts can be mobilized from soils. Aluminum has also been found to be an important factor in the buffering of soil water whose pH is less than 5.5. The mobilization of cadmium, lead, and asbestos from soils as a result of acid rain is less well understood; investigators have tested for these substances in general scans of soil water but have not yet found any significant concentrations.

- Compartment 5

The chemistry of unconsolidated aquifers is variable, depending on the mineral composition of the formations. Often silica is a dominant component, and silica is essentially insoluble in water and chemically inert. Compared with other compartments in the Pathway, unconsolidated aquifers tend to have a minor effect on the quality of water passing through them.

- Compartment 6

Bedrock aquifers are extremely variable. Granitic bedrocks are resistant to attack by water and will alter water quality very little. Limestone aquifers, on the other hand, are highly effective in neutralizing acidic water. The degree and nature of fracturing or cavelike features influence the degree of contact with groundwater. Water may pass through a large fracture or cavity very quickly without substantial chemical alteration. Unfractured rock, on the other hand, is relatively impervious to water, preventing chemical interaction. From this perspective, a rock formation with extensive interconnected fractures or cavities may effectively alter water quality.

- Compartment 7

Chemical changes occur in surface waters as well. The complexities of aquatic ecosystem response to acid rain are aptly illustrated in a recent paper by Kilham (1982) which documents a case in which a eutrophic lake became more alkaline as a result of acid rain. The mechanisms involved changes in the biochemistry of the lake. An important part of a surface water body is its sediment. Calcareous sediments may help neutralize an acidic input. On the other hand, acidification may release aluminum, cadmium, or lead from sediments. Many studies have demonstrated that aluminum concentrations are elevated by acidification of lakes and streams. There is much less evidence of cadmium elevation as a result of acidification, while several studies have demonstrated that acid rain has not resulted in the release of lead from lake sediments (Norton, et al., 1981; Davis et al., 1982).

- Compartment 8

When groundwater is extracted from an aquifer via a well, a variety of chemical changes may occur. Typical well installations have PVC or galvanized steel casings and are sealed to prevent exchange of atmospheric gasea. With such installations, the quality of the water will be little altered by the well itself. For wells which are not sealed, re-equilibration of dissolved CO_2, O_2, and H_2S may result in significant changes in pH (most likely an increase as dissolved CO_2 escapes from the water) and precipitation of some metals.

- Compartment 9

Potable water collected from surface waters or wells must often be conveyed significant distances, tens to hundreds of miles in some cases, before it reaches the treatment plant. Temporary storage systems (reservoirs, tanks) are often involved. Materials of construction in these conveyances and storage systems are varied; they include, for example, cement (including asbestos cement), asphalt, cast iron, steel, and various plastics. Interactions with all of these materials, in conjunction with changes between aerobic and anaerobic conditions, can significantly affect the quality of the water passing through. Of key concern is the pick up—due to corrosion or leaching—of potentially harmful materials such as asbestos and metals.

More dramatic changes in the water quality occur in the treatment plant, the extent of the changes depending heavily on the type of treatment. Common treatment processes may be designed to clarify the water (coagulation and filtration, sedimentation); soften the water (lime addition); remove "off" tastes and odors (powdered carbon absorption); reduce corrosion in the distribution system (raise the pH); remove toxic organics (granular carbon absorption); remove iron (ion exchange, oxidation/precipitation); control pathogens (chlorination); remove salt (reverse osmosis, distillation); and add fluoride.

Most of the treatment processes designed to remove unwanted constituents, as well as raising the pH for corrosion control, will result in significant removals of heavy metals. Some new chemicals may, however, be introduced including aluminum which is a flocculating agent. The pH of the water may also be altered during many of these treatment processes.

There are regulatory standards that must be taken into account by public water treatment facilities, and these can affect residual levels of lead and cadmium, specifically. (See Appendix A.)

- Compartment 10

The main water distribution system carries the water from the treatment plant, or storage areas, to all of the service areas. The materials of construction in contact with the water may include cement (including asbestos cement), cast iron, steel, and plastic. Materials such as coal tar, lead and epoxies have been used to seal joints. Changes in the water quality may occur (including pH changes) during passage through the distribution system. Corrosion, scaling, leaching, biological action, and various chemical reactions (e.g., reduction) may occur. Changes in some systems are significant enough that water quality deterioration in drinking water distribution systems has been of real concern to state and federal regulatory agencies.

- Compartment 11

Pipe connections from the local distribution pipe to the home are usually made of cast iron or plastic. In older service areas, however, lead pipes were often used, and this has led to potentially serious lead contamination of household waters. The highest lead levels (in these cases) are seen in samples of water taken after a period of no water use (e.g., the first water use in the morning) because the water has lain stagnant in the lead pipes.

Interior plumbing is usually copper, but lead-based solders are commonly used on joints. Pick up of lead and copper is also possible in such cases.

A significant number of households have individual water treatment units, e.g., for softening, filtration, and taste and odor control. These will also affect the chemistry of the water delivered, primarily by removing unwanted chemical species or particles.

The flow of water through the Pathway varies from one watershed (or town) to another. It is difficult to generalize, but it is possible to describe the principal overall routes from rainwater to the domestic tap. Individual routes can be denoted, in shorthand fashion, by the numbers of compartments which are so linked, e.g., (3-7) linking the land surface with surface water bodies, commonly referred to as surface runoff.

Most rain in rural and suburban settings is intercepted by vegetation (1-2). During any significant storm, this rainfall rapidly drips to the land surface (2-3). Direct rainfall on the land surface (1-3) is important in urban areas, or on agricultural land shortly after tillage.

Most rainfall, upon reaching a soil surface, infiltrates (3-4) to upper soil horizons. Surface runoff (3-7) is generally conceded by hydrologists to be a relatively minor route for most rainfall landing on natural soil surfaces. On the other hand, surface runoff is very important in urbanized watersheds, where a large fraction of the surface area is paved, and whenever the ground surface is frozen. A portion of the water which infiltrates to upper soil horizons will move laterally toward the surface water body, a process known as interflow (4-7). This interflow water probably re-emerges as surface runoff and re-infiltrates several times on its path to a stream or lake. The determination of the interflow and surface runoff contributions to stormflow is a difficult hydrologic problem, and there is little basis for general conclusions regarding the relative importance of (3-7) vs. (4-7).

A significant fraction of infiltrating water percolates through (4-5) the upper soil horizons to subsurface alluvial aquifers (sand and gravel deposits left by ancient stream beds) and to bedrock aquifers (5-6). For simplicity, the plausible (4-6) linkage has been left out. In some isolated areas, bedrock may outcrop at the earth's surface, and receive a direct recharge from rainwater (1-6). Aquifers generally discharge to surface water (5-7) and (6-7). This groundwater discharge is a steady year-round source of water to streams, which predominates between rainfall events. Of course, some rainfall falls directly on surface waters (1-7), but this direct deposition is a small contribution to the water budget of streams and most lakes and reservoirs.

Following the aforementioned routes, rainwater has arrived at the water supply source, be that a river, lake, reservoir, or groundwater aquifer. Most households are part of a municipal water supply system. Most municipal systems in the Eastern U.S. withdraw and treat surface water (7-9) prior to distribution (9-10), but an important fraction of all municipal systems draw upon groundwater (8a-9). Groundwater frequently is used because it does not require treatment (8a-10). A relatively smaller volume of surface water withdrawn for potable supplies is used without treatment (7-10). Very little surface water is utilized directly by individual households (7-11). On the other hand, individual domestic wells (8b-11) are an important component of American potable water supplies. Rooftop collection of rainwater with interior storage in cisterns (3-11) is uncommon in the continental U.S. The volume of water consumed directly from the source (7-12) or (8-12) is insignificant. Table 1 provides more quantitative data on the man-made part of the Pathway (below compartments 7 and 8).

The Pathway (and Figure 1) may be summarized as follows. The route of water through this system is highly variable from place to place and on a seasonal basis. Nonetheless, some reasonable generalizations can be made. Most people in the Eastern U.S. derive their drinking water from municipal systems drawing upon surface waters. In shorthand notation, referring to Figure 1, the routes are (1-2-3-4-7-9-10-11-12) and (1-2-3-7-9-10-11-12). Assuming typical treatment practice (compartments 9 and sometimes 11), as well as uncontrollable chemical alterations occurring in compartments 2, 4, 7, and 10, the quality of this water is likely to bear very little relationship to the quality of the rain.

Smaller, but still significant, volumes of domestic tap water follow such alternate routes as (1-2-3-4-5-6-8-9-10-11-12 and 1-2-3-4-5-8-9-10-11-12; municipal groundwater supply), (1-2-3-4-5-7-9-10-11-12 and 1-2-3-4-5-6-7-9-10-11-12; municipal surface water supply), and (1-2-3-4-5-8-11-12 and 1-2-3-4-5-6-8-11-12; domestic wells). Note that in each of these routes the water flows through many compartments, each of which may alter its quality. Only the last route mentioned above (domestic wells) bypasses a municipal treatment and/or distribution system. The quality of tap water derived from this route is likely to be strongly influenced by the quality of rainwater only if the subsurface compartments (4, 5, and 6) are ineffective in altering the water quality. This condition may be realized in unbuffered non-calcareous watersheds such as those of the Adirondacks region. The neutralizing capacity of compartments 4, 5, and 6 is also an important determinant of water withdrawn from surface waters, but this Pathway almost invariably passes through compartments 9 and 10, further weakening the relationship between rainwater and tap water quality.

By far the greatest amount of water in domestic use has passed through several compartments (micro-environments), where its quality has likely been altered. Consequently, there is very little, if any, relationship between the quality of such tap water and the quality of rain which is its original source. There are a few "short-circuit" routes through this system--i.e.,

TABLE 1

WATER WITHDRAWALS FOR POTABLE SUPPLIES IN THE EASTERN U.S. - 1975[a]

[Values in million gallons per day]

Withdrawal for:	Surface Water	Ground Water	Total
Public water supply	13,000	5,450	18,500
Rural domestic use	38	1,750	1,790

[a] Eastern U.S. consists of 27 states east of the Mississippi plus the District of Columbia.

Source: "Estimated Water Use in the United States in 1975," Geological Survey Circular 765, U.S. Geological Survey, Arlington, Virginia.

those which pass through a minimum number of compartments--which are more likely to exhibit a discernible relationship between tap water quality and the quality of the source precipitation. Such "short-circuit" routes include (1-7-9-10-11-12; direct deposition on surface waters used for potable supply); (1-3-11-12; cisterns); and (1-6-8-11-12; domestic wells tapping bedrock aquifers receiving direct recharge via outcrops). These "short-circuit" routes, however, represent a relatively small number of households.

B. Human Exposure Routes and Toxicology

In order to assess the incremental effect of acid rain on human health via the Pathway, it is important not only to establish a relationship, if any, between the quality of precipitation and the levels of the Contaminants in drinking water, but also to determine the incremental contribution, if any, of such Contaminants in drinking water to the total intake of the Contaminants in humans. In the OTA and NCSU draft reviews, no perspective is given on the latter issue.

Aluminum, cadmium, asbestos and to a somewhat lesser extent, lead, are poorly absorbed from the gastrointestinal tract. Furthermore, drinking water is not the major exposure pathway for these Contaminants. Even if the presently existing ambient concentrations of these Contaminants in drinking water (with or without the supposed contribution of acidic deposition) were reduced to zero, the health hazards associated with intake of these substances would still exist. Also, no perspective is provided with respect to the size of the population at risk from the presumed incremental health burden nor the magnitude of that risk.

A general review of the toxicology of the Contaminants, together with estimates of the relative importance the drinking water Pathway plays in human exposure, is presented below:

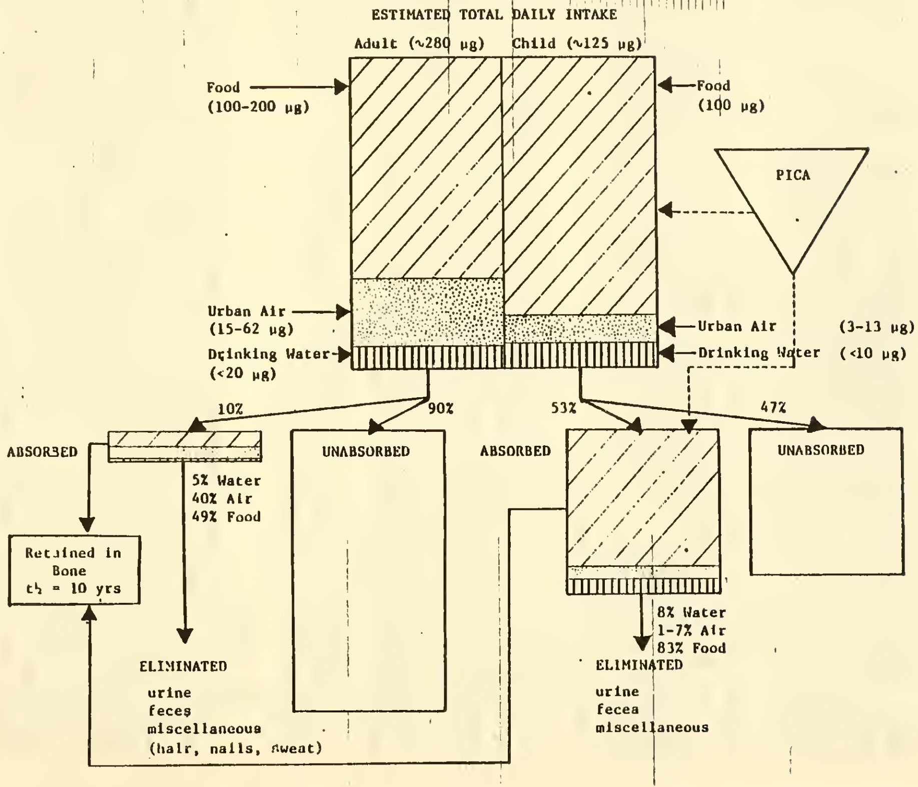
1. Lead

Lead is a low-level environmental pollutant with many possible sources and numerous pathways for exposure. The system is complex and little is known as to the relative contribution of each particular source or pathway. Lead has no known natural function in the body and no beneficial effects have yet been found. Due to its accumulation in bone, even a low daily intake of lead can eventually produce toxic effects. Children are at greatest risk from lead exposure in that they retain proportionally more lead than adults, making them vulnerable to toxic effects of lead at lower levels. In an adult, between 5 to 10% of ingested lead is absorbed. Increased absorption (53%) is noted in infants and young children. By inhalation, 30% of inhaled lead is deposited in the lungs (WHO, 1977). Lead salts do not readily penetrate intact skin (WHO, 1977).

The estimated total daily intake of lead is shown in Figure 2. As shown there, food is generally by far the largest source of lead exposure for adults, although none of the exposure routes can be considered unimportant because both drinking water and air can result in more significant exposures in some situations. Similarly, pica (contact with dust and dirt, consumption of paint chips) is considered the largest exposure route of lead for children.

FIGURE 2

HUMAN CONSUMPTION OF LEAD



Intake of lead in food is thought to be the primary pathway for adults in the general population and for children without pica (Mahaffey, 1978). The contamination of food through the use of lead solder in cans represents the most widespread source of lead in the diet. Estimated typical dietary intake for adults ranges from 100 to 200 micrograms (Tepper, 1971; Kolbye, et al., 1974; Gross, 1979). Average dietary intake for children ranges from 12 to 150 micrograms per day, with a mean intake of about 100 micrograms (Mahaffey, 1978).

The amount of lead that drinking water adds to normal intake is a matter of some controversy, but drinking water generally contributes less than the lead intake through food and air. Assuming a consumption of two liters per day for adults (one liter/day for children), most adults in the U.S. ingest less than 20 micrograms of lead per day from drinking water (less than 10 micrograms/day for children) (USEPA, 1980a). Of course, lead intake from drinking water would increase with more highly contaminated water. For example, consumption of drinking water with a lead content of 50 micrograms per liter (the U.S. ambient water quality criteria) would increase the contribution to the blood lead level by 5 micrograms above that noted with drinking water containing 10 micrograms per liter (blood lead levels would be 23.58 vs. 18.37 micrograms per 100 milliliters of blood, respectively) (Moore, et al., 1977).

Inhalation of ambient air is also a major pathway of lead exposure, particularly in urban areas. Urban air concentrations of lead range from 1 to 4 micrograms per cubic meter outdoors, and 0.3 to 1.4 micrograms per cubic meter indoors (USEPA, 1977). The major source of lead in the atmosphere derives from automobile emissions. Assuming inhalation of 20 cubic meters per day for adults (4 cubic meters for a child), under worst case conditions, i.e., spending one third of their time indoors and the remainder outdoors, exposures would range from 15 to 62 micrograms per day (3 to 13 micrograms daily for a child). Exposure via this pathway is far more complicated for children because deposited particulates from automobile emissions, paint chips, etc., result in contamination of dust and soil. Inadvertent ingestion of lead from mouthing contaminated hands or other objects is not easily quantified. A small child playing in dirt with a lead concentration of only 1200 micrograms per gram could ingest about 12 micrograms of lead by mouthing his fingers just once (Lepow, et al., 1974). The ingestion of paint chips may be an even more significant source of lead exposure. Even a small amount of paint containing 1% lead can result in an exposure of 1000 micrograms per day (Mahaffey, 1978).

One of many problems associated with quantification of human exposure to lead is defining typical background levels. An additional problem arises from the use of blood lead levels (PbB) as an indication of exposure. PbB levels indicate relatively recent exposure (Needleman, et al., 1979). Also, it is difficult to identify the source of exposure from PbB levels except through the use of statistical methods. Because children are more sensitive to the effects of lead than adults, the Center for Disease Control and the American Academy of Pediatrics recommend that the maximum blood lead level for any given child not exceed 30 micrograms per 100 milliliters of blood. Most adults in the U.S. have mean PbB of 10 to 20 micrograms per 100 milliliters.

Three organ systems are major targets of lead toxicosis: the heme-hematopoietic system (Hammond, 1977), the kidney (Goyer, 1979) and the nervous system (Granick, et al., 1978). Subtle neuro-behavioral impairments have also been reported at blood lead levels in which no overt symptoms of lead toxicity are seen (40 micrograms per 100 milliliters) (USEPA, 1980a). High occupational exposures to lead have resulted in profound adverse effects on the fetus and have interfered with the reproductive ability of both men and women at blood lead levels of 30 to 40 micrograms per 100 milliliters (WHO, 1977). There is no evidence that lead produces birth defects in humans.

Evidence for a possible association of lead exposure and chromosomal aberrations in man is inconclusive and contradictory. Chromosomal aberrations have been reported in some workers in lead industries (WHO, 1977). Numerous other observations have been essentially negative (WHO, 1977). Data from animal studies are also conflicting.

Although human data on the carcinogenicity of lead are scant, there is no evidence to suggest that lead is carcinogenic to man (USEPA, 1980a). Experiments with rodents have shown that the addition of 0.1 to 1% basic lead acetate to the diet of rats and mice or 1% lead acetate to the diet of rats (USEPA, 1977) resulted in an elevated incidence of renal tumors; however, the equivalent human dose (550 milligrams of elemental lead per day) is far in excess of the maximum tolerated dose of lead in man.

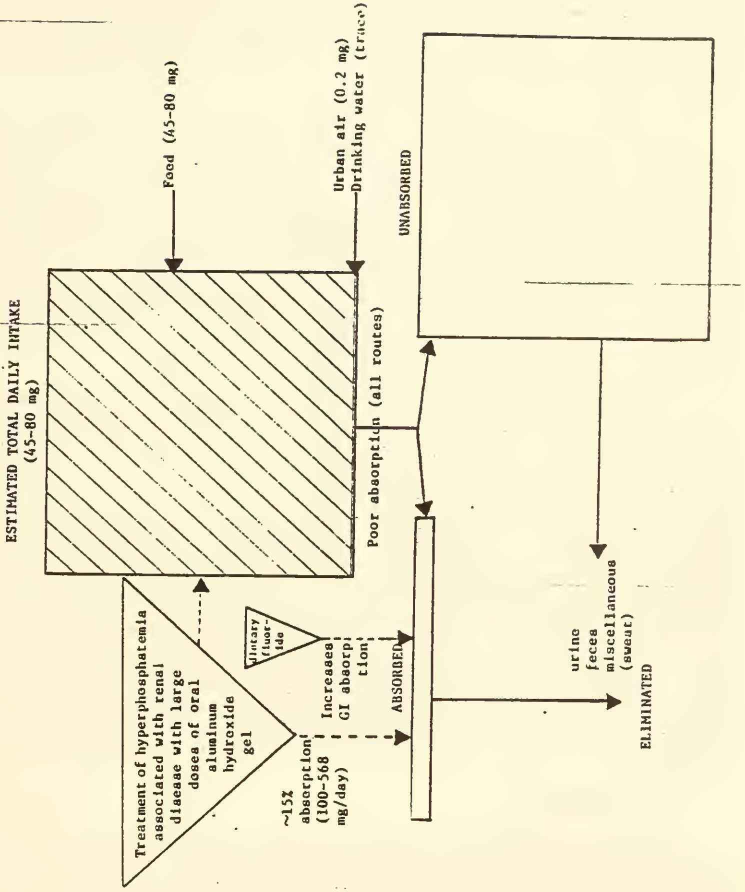
2. Aluminum

Exposure to aluminum and aluminum compounds is a common daily experience for most individuals. Food represents, by far, the largest source of exposure (see Figure 3). Aluminum compounds are utilized in the processing, packaging, and preservation of food and as a food additive for various purposes. Aluminum is also present naturally in foods in varying amounts. Some fruits and vegetables contain up to 150 milligrams aluminum per kilogram, although most unprocessed foods contain less than 10 milligrams per kilogram (Norseth, 1979). Thus, daily intake from food may show considerable variation depending on the diet. The daily dietary intake of aluminum by adults in the U.S. ranges between 45 and 80 milligrams per day (Venugopal and Luckey, 1978; Norseth, 1979). Inspired air contains about 10 micrograms aluminum per cubic meter in urban areas and less than 0.5 micrograms per cubic meter in non-urban areas (Norseth, 1979). Drinking water typically contains only trace levels of aluminum (Norseth, 1979). Aluminum compounds are also used therapeutically as antacids, antiperspirants, antiseptics and to prevent hyperphosphatemia in renal disease (Norseth, 1979).

No reliable data exist on the absorption of aluminum but the presence of small amounts of aluminum in human organs suggests that some absorption of aluminum does occur (Venugopal and Luckey, 1978). Absorption from the human gastro-intestinal tract was reported in connection with the use of

FIGURE 3

HUMAN CONSUMPTION OF ALUMINUM


ESTIMATED TOTAL DAILY INTAKE (45-80 mg)
Food (45-80 mg)
Urban air (0.2 mg)
Drinking water (trace)
UNABSORBED
Poor absorption (all routes)
Treatment of hyperphosphatemia associated with renal disease with large doses of oral aluminum hydroxide gel
~15% absorption (100-568 mg/day)
Dietary fluoride
Increases GI absorption
ABSORBED
urine
feces
miscellaneous
(sweat)
ELIMINATED

aluminum hydroxide gel for the treatment of hyperphosphatemia associated with end-stage renal failure (Clarkson, et al., 1972). An average absorption of about 15% was observed but considerable variation was noted among test subjects.. To what extent existing kidney damage caused increased retention is uncertain. Estimates of absorption in individuals with normal kidney function have not been published.

In mammals, absorption of ingested aluminum is poor due to its high affinity for phosphate which results in the formation of insoluble aluminum phosphate (Venugopal and Luckey, 1978). Dietary fluoride has been observed to increase gastro-intestinal absorption of aluminum in rats (Venugopal and Luckey, 1978). Due to its limited absorption, aluminum present in feces probably reflects the amount ingested. Low levels (0.05 to 1 milligram per liter) have also been noted in urine (Kehoe, et al., 1940; Tipton, et al., 1966). The biological half-time ($t_{\frac{1}{2}}$) for aluminum is not known but there is no evidence that the body burden of aluminum increases with age. This lack of accumulation as well as the lack of increased tissue levels following fairly high dietary aluminum exposures suggest the existence of homeostatic regulation of aluminum absorption in humans.

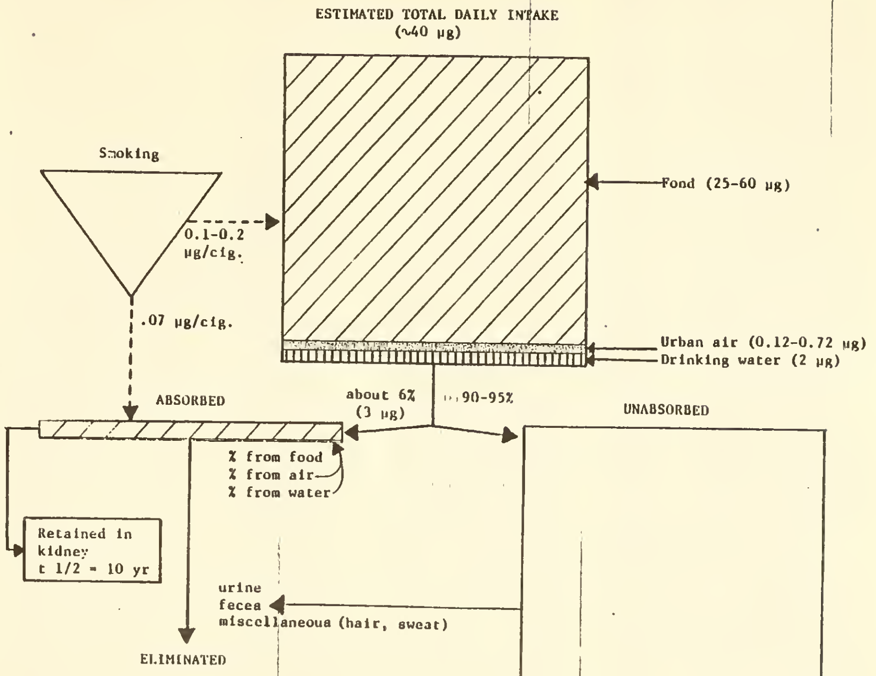
Historically, aluminum has been regarded as non-toxic, primarily due to its poor absorption by the oral, inhalation, and dermal routes. Most human experience with the toxicity of aluminum comes from individuals with end-stage renal failure. These individuals must undergo several hemodialysis treatments weekly. During these treatments, the individual's blood is exposed across a dialyzer membrane to 100 to 240 liters of water, and any aluminum present in the water transfers across the membrane into the individual's bloodstream. The adoption of performance standards for water purifiers, piping, etc., could prevent this complication. A far greater source of increased aluminum exposure among dialysis patients, however, is the use of large doses of aluminum hydroxide gel to prevent severe phosphate retention due to kidney failure (Clarkson, et al., 1972). The resulting increased levels of aluminum have been linked to a neurologic syndrome known as dialysis encephalopathy. Whole brain aluminum levels in affected individuals are 12 times higher than those of controls (Alfrey, et al., 1976). Elevated brain aluminum levels have also been demonstrated in individuals with Alzheimer's disease, a disabling dementia (Mayor, et al., 1977). In the general population, however, exposure to aluminum via drinking water is inconsequential.

3. Cadmium

In the general population, the primary routes of cadmium exposure are through the respiratory and gastro-intestinal tracts. Although food (25 to 60 micrograms per day) and water consumption (most supplies: 1 microgram per liter) account for the majority of daily cadmium intake (see Figure 4), they represent a minor route of exposure since cadmium is poorly absorbed from the gastro-intestinal tract. The currently accepted estimate of gastro-intestinal absorption in humans is about 6% (range 4.7 to 7%) (Bremner, 1979). Several dietary factors such as deficiencies in calcium, vitamin D, zinc, iron and copper or low-protein diets have been shown to enhance gastro-intestinal absorption of cadmium (Ryan, et al., 1978).

FIGURE 4

HUMAN CONSUMPTION OF CADMIUM



Inhalation is the primary route of exposure due to more efficient absorption of cadmium through the respiratory tract; i.e., about 25% depending on the type of compound, particle size, and lung function (Piscator and Pettersson, 1977). Assuming a respiratory flow of 20 cubic meters per day and a reported range of 0.006 to 0.036 micrograms cadmium per cubic meter in urban air, estimated daily intake from air ranges from 0.12 to 0.72 micrograms, 25% of which is absorbed. Additionally, since tobacco contains cadmium (0.1 to 0.2 micrograma per cigarette), a heavy smoker might absorb about the same amount from smoking as from food.

Absorbed cadmium is deposited in the liver and ultimately in the kidney; excretion is slow (0.005% of the total body burden per day), corresponding to a biological half time of more than 10 years (Friberg, et al., 1979). Accumulation, therefore, increases with age.

Long-term, low-level exposure to cadmium can result in chronic pulmonary disease (emphysema) and renal disease (primarily a reabsorption defect in the proximal tubules). The characteristic first sign of renal damage is proteinuria (Friberg, et al., 1979; Nomiyama, et al., 1980). Other renal effects such as aminoaciduria, glucosuria, and phosphaturia may occur later. The critical concentration of cadmium in the renal cortex has been estimated to be about 200 micrograms per gram (WHO, 1977). To prevent the kidney from reaching this critical concentration, WHO (1977) recommends that daily intake should be limited to about 70 micrograms.

Other effects from chronic cadmium exposure include decreases in hemoglobin levels, caused by interference with iron absorption, and decreased haptoglobin levels, indicating a possible hemolytic effect (Friberg, et al., 1979). Cadmium exposure has also been associated with mineral depletion in bone in laboratory animals after high oral cadmium exposures and in industrially-exposed workers and in Japanese ingesting excessive amounts of cadmium in rice (Itai-itai disease) (Friberg, et al., 1979; Ryan, et al., 1978).

Although cadmium has been associated with an increase in the incidence of prostate cancer among occupationally-exposed workers (Kipling and Waterhouse, 1967; Lemen, et al., 1976), conclusive evidence to implicate cadmium as a human carcinogen remains to be established. Several long-term feeding studies with dogs, rats and/or mice reported no induction of tumors after exposure to as much as 10 parts per million cadmium in drinking water or 4 milligrams per kilogram body weight administered by stomach tube for up to lifetime exposures. Similar negative results were found with inhalation exposure of rats (Ryan, et al., 1978).

4. Asbestos

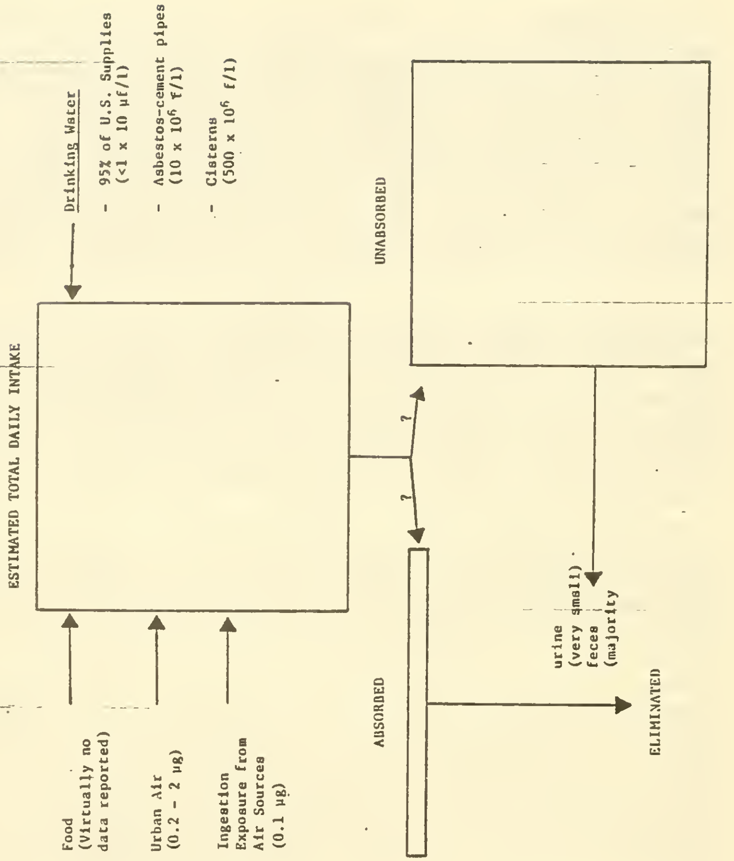
The evidence linking increased human lung cancer with prolonged inhalation of asbestos fibers is clear (IARC, 1977). Relatively little is known, however, about the biological effects of ingested asbestos. Concern about the possible effects of ingested asbestos stems primarily from findings of an increased prevalence of tumors of the digestive tract among asbestos workers (Craighead and Mossman, 1982). These gastro-intestinal tumors are explained by the assumption that a fraction of inhaled fibers deposited in the lung is subsequently carried up the bronchial tree from deeper lung airways on the mucociliary "escalator" and swallowed. The USEPA (1980b) estimates this ingestion exposure from air sources to be approximately 0.1 micrograms per day.

Results of several animal feeding studies have not thus far shown any conclusive health risk of asbestos in drinking water (IARC, 1977; Bolton, et al., 1982; NTP, 1983). However, the detection of asbestos fibers in the urine of humans ingesting asbestos-contaminated drinking water indicates that ingested asbestos fibers can penetrate the digestive tract (Cook and Olson, 1979) and Kanarek and co-workers (1980) reported a significant association between asbestos levels in drinking water in areas around San Francisco and male stomach and lung and female peritoneal, gall bladder and esophageal cancers. It appears prudent, therefore, to maintain a low level of asbestos fibers in drinking water supplies.

Although asbestos is widely used in construction, insulation, fire protection and textiles, there is a paucity of data on the extent of exposure in the general population (see Figure 5). Although asbestos filters are used in processing such food items as beer, wine, liquors, fruit juices, and vegetable oil, levels in food are not well established (Levine, 1978). Asbestos is commonly found in domestic water supplies. Certain U.S. water systems such as those of Seattle, Washington (1 to 10 x 10^6 fibers/liter) and San Francisco, California (10^7 fibers/liter) have high levels of asbestos due to natural erosion of asbestos deposits in their watersheds (USEPA, 1980b). A recent study by Millette, et al., (1981b) found that 11% of water samples from 426 U.S. water supplies had fiber concentrations, at least on occasion, of over 10 x 10^6 fibers per liter. On average, most U.S. drinking water supplies contain less than 1 x 10^6 fibers per liter, resulting in direct water ingestion exposures of less than 0.02 micrograms per day (USEPA, 1980b). The distribution of drinking water through asbestos cement pipes in some municipalities may also, under certain conditions, add significant amounts of asbestos to the water supply. Millette, et al., (1980, 1981a) reported values of over 10 x 10^6 fibers per liter but noted that the extent of shedding of asbestos fibers from asbestos cement pipes could be controlled by filtration or conditioning the water. A small percentage of the U.S. population obtains its drinking water from cisterns utilizing asbestos-cement roofing tiles to collect water. Concentrations of over 500 x 10^6 fibers per liter have been found in tap water drawn from such systems (Millette, et al., 1980).

FIGURE 5

HUMAN CONSUMPTION OF ASBESTOS


ESTIMATED TOTAL DAILY INTAKE
Drinking Water
- 95% of U.S. Supplies (<1 x 10 μf/l)
- Asbestos-cement pipes (10 x 10⁶ f/l)
- Cisterns (500 x 10⁶ f/l)
Food (Virtually no data reported)
Urban Air (0.2 - 2 μg)
Ingestion Exposure from Air Sources (0.1 μg)
?
?
UNABSORBED
ABSORBED
urine (very small)
feces (majority
ELIMINATED

The scant data available on ambient air concentrations of asbestos indicate that concentrations not exceeding 100 nanograms per cubic meter and usually less than 10 nanograms per cubic meter are present in the general urban atmosphere. Reported levels in rural air range between 0.01 and 0.1 nanograms per cubic meter (Selikoff, et al., 1972; Levine, 1978; IARC, 1977).

5. Summary of Exposure Routes

As shown by the above discussion (and Figures 2-5), the drinking water Pathway is not a major route of exposure to lead, aluminum, and cadmium for most individuals, particularly in relation to their much greater exposure via the food Pathway, and the data on asbestos are insufficient to determine the major route of exposure to asbestos in the general population. In short, the Pathway does not appear to be an important health problem for the general population. For those individuals in particular subgroups of concern (i.e., for whom the Pathway may be a significant source of exposure to the Contaminants, especially lead and asbestos), more information is needed on the relative importance of the Pathway in relation to other sources of exposure.

C. Critical Review of Relevant Research

In this section, the results of some relavant studies are summarized, including their important findings and any potential critical limitations and shortcomings.

1. Studies on Metals

Dr. Wolfgang Fuhs and co-workers at the New York State Department of Health have analyzed the concentration of several metals in drinking water sources (natural waters) and tap water at various locations in the Adirondacks, an area affected by acid rain (Fuhs, 1979; Fuhs and Olsen, 1979; Fuhs, 1981; Fuhs, et al., 1982). In several instances, the analyses were performed after routine screening of the blood of children revealed unusually high levels of lead. In three such cases, where the homes (on the western slopes of the mountains) were served by lead piping which carried water from hillside springs, lead levels exceeded the U.S. drinking water standard (50 μg/l), with levels in unflushed (first draw) samples as much as 100 times that standard. Significantly lower levels were observed in source waters[1], tap water from other flushed lines[2], and all samples from the eastern slopes. Water from shallow wells (less than 10 feet) and springs was at least 10 times more acidic than water from wells over 50 feet deep. Levels of copper also exceeded the drinking water standard in some tap samples, including one home served by a municipal water supply. In addition, elevated levels of aluminum (from 0.3 to 1.5 mg/l) were found in springs and shallow wells. Cadmium levels were not problematic in any of the samples collected.

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[1] Lead levels in source waters were usually negligible, but one sample exceeded the drinking water standard by 60%.

[2] Most such samples were low in lead, but in six cases concentrations of 10 to 130 μg/l were observed.

Dr. Fuhs has presented convincing evidence that pathway (1-2-3-4-8b-11-12) can result in levels of lead and copper which substantially exceed drinking water standards. Further, his data suggest that the dominant source of these metals in tap waters is from corrosion of lead and copper pipe and lead solder, with much lower concentrations in natural waters. In one instance, corrosion of copper pipes apparently led to high levels of copper in tap water from a municipal system, where the research team found that acidic water was being distributed as a result of operator errors, which were easily correctable. The Langelier Index[3] was used to infer that the source water was corrosive to lead pipe or to copper pipe with lead solder connections. Finally, replacement of lead pipes and/or neutralization of the source water were suggested as suitable mitigation procedures. Although Dr. Fuhs has suggested that acid precipitation has affected drinking water quality in the Adirondacks, his research with others at the New York State Department of Health, has not established the contribution of acid precipitation to this problem, relative to natural processes.

Turk and Peters (1978) have addressed this issue in a study of rock weathering in the same region of New York, finding that acid rain accounts for 45% of rock weathering (net cation discharge from the watershed) in the region, the remaining 55% being due to natural interactions among atmosphere, rock, and soil water. They also found elevated levels of copper and lead in water from unflushed pipes in the area, inferring that the concentration would be largely dependent on pH of the water in the distribution system. They conclude, however, that the data will not support an estimate of "the extent to which increased precipitation acidity and decreased pH of water has intensified the corrosion of pipes."

In studies relevant to municipal distribution systems, the U.S. EPA and the Metropolitan District Commission (water supply agency for the Boston Metropolitan area) have investigated the extent of corrosion of lead pipes in the Boston area by the soft, acidic water characteristic of the source water in that area (Karalekas, et al., 1975; Karalekas, et al., 1977; Karalekas, 1980; Karalekas, et al., 1982). Several other municipal systems in New England were also investigated including those of Bennington, Vermont; and New Bedford, Massachusetts (Karalekas, et al., 1977; Karalekas, 1980). These studies were initiated as early as 1975, and corrosion mitigation programs have been implemented since 1976. Karelekas, et al. (1975), clearly showed that water from unflushed lead service lines contained potentially harmful levels of lead, prior to mitigation. The adopted mitigation strategy is pH adjustment (to pH greater than 8) via addition of sodium hydroxide, sodium bicarbonate, or sodium carbonate (soda ash). Maintenance of source water pH at above 8 has been effective in lowering lead concentrations in tap water (Karalekas, 1980; Karalekas, et al., 1982). Acid rain has not been identified as the ultimate cause of this problem, but research is under way to evaluate the role of acid rain in this phenomenon.

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[3] The Langelier Index is a measure of the potential for water to form or dissolve calcium carbonate scale on the surface of pipes.

2. Studies on Asbestos

The release of asbestos from asbestos cement pipe in potable water supplies has been studied extensively, but the role of acid rain in this phenomenon has not been evaluated. Several studies (Millette, et al., 1980a; Millette, et al., 1980b; Millette, et al., 1981a; Millette, et al., 1981b; Kanarek, et al., 1980; Kanarek et al., 1981) have indicated that potentially harmful levels of asbestos are present in some potable water supplies, and that (in addition to other sources such as erosion and pollution) asbestos can be released from asbestos-cement materials used in water supply systems--specifically, piping and rooftop rainwater collectors. Typically, investigators have presented their results in the context of a corrosion index, the Aggressiveness Index (AI).* Millette, et al. (1980c), found a good correlation between AI and tap water asbestos counts. Kanarek, et al. (1981), on the other hand, found that asbestos was released from piping in a system (San Francisco) with "non-aggressive" water (as indicated by the AI). The results of Kanarek, et al. (1981), thus call into question the AI as a predictor of asbestos fiber release, and indicate that other factors (besides pH, alkalinity, hardness, and temperature) may be important. Millette, et al. (1980a) report that "asbestos fibers found in cistern water collected from asbestos tile roofs are among the highest found in all drinking waters tested." The cistern water samples were taken from the U.S. Virgin Islands and Southwest Ohio. This situation corresponds to route (1-3-11-12), an extreme "short-circuit" route from Figure 1. Again, however, none of these studies considers the effect of acid rain on the release of asbestos from asbestos-cement pipes and cisterns.

3. Discussion of Studies

The studies summarized above, and the general body of related technical literature, fail to demonstrate a relationship between the acidity of precipitation and the concentration of metals or asbestos in tap water, even for individuals who receive their water through a "short-circuit" route. The primary reason for this is that the studies provide no basis for determining what fraction, if any, of the reported concentrations of metals or asbestos is attributable to acid rain as compared with other sources. The work of Fuhs and his co-workers, which is the most suggestive of a relationship between acid rain and elevated metals concentrations in drinking water, fails to demonstrate that acid rain is the cause, because (among other things) it lacks a companion "control" study region with similar geology and water supply system but less acidic precipitation. Thus, the results of that work fail to answer the critical question: Would lead be leached, at similar concentrations, from lead piping in any soft water region with granitic bedrock, regardless of the acidity of the rain?

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*The AI is a measure of the potential for water to corrode asbestos-cement pipe. It takes into account the pH, alkalinity, and hardness of the water.

Concern over increased human exposure to metals and asbestos as a result of acid rain is ultimately based upon consideration of the physical chemistry of the Pathway which suggests that there "ought to be" a relationship: most metals are more soluble at low pH, and acidic water is more corrosive. The argument is reasonable but speculative. The theory supporting this argument has been formalized via a variety of corrosive indices which have been proposed over the years to account for the relationship between corrosion rates and the characteristics of a given water supply. Indices used in the cited literature, the Langelier Index and the Aggressiveness Index, are both expressions of the tendency to form or dissolve calcium carbonate scales. The Aggressiveness Index was specifically developed to assess the corrosion of asbestos-cement pipe. The Langelier Index, on the other hand, was originally developed to assess corrosion of iron pipe. Although both are generally believed to be good indicators of corrosion potential, neither accounts for all the complexities of the corrosion process and are not accurate predictors of corrosion rates (Singley, 1981). Neither was developed to predict leaching rates of lead from lead piping or soldered joints. Kanarek, et al. (1981), question the validity of the AI for prediction of fiber release from asbestos-cement pipes, on the basis of their finding that asbestos is released from pipes in the San Francisco distribution system even though the water is classified as non-aggressive via the AI.

Any conclusions or inferences that acid rain is the cause, or even a contributing factor, in the observed elevated levels of the Contaminants are ultimately based on the physical chemistry theory (whether or not that theory is expressed via an index) that if water is more acidic it will be more corrosive. As a practical matter, the relationship is far more complex and only imperfectly understood. Further, the incremental contribution of acid rain to the corrosivity of these water supplies has not been determined yet, and this is a critical piece of missing evidence.

In addition, the above-cited studies, as well as related research, have not addressed the importance of exposure to the Contaminants through drinking water relative to the total body intake and absorption of the Contaminants from other sources. This incremental effect must also be carefully evaluated before conclusions can be drawn about any indirect health effects of acid rain.

III. OVERALL ASSESSMENT

At the present time, there is insufficient evidence to support a conclusion that acid rain produces or contributes significantly to adverse health effects by the indirect route of mobilizing lead, aluminum, cadmium, or asbestos in drinking water. A comprehensive risk assessment, which would probably require the development of new data, would be required to appropriately evaluate the magnitude of any such health effects. In the course of the present investigation, several important issues which would need to be addressed in such an assessment have been identified. In this section, these issues will be qualitatively addressed.

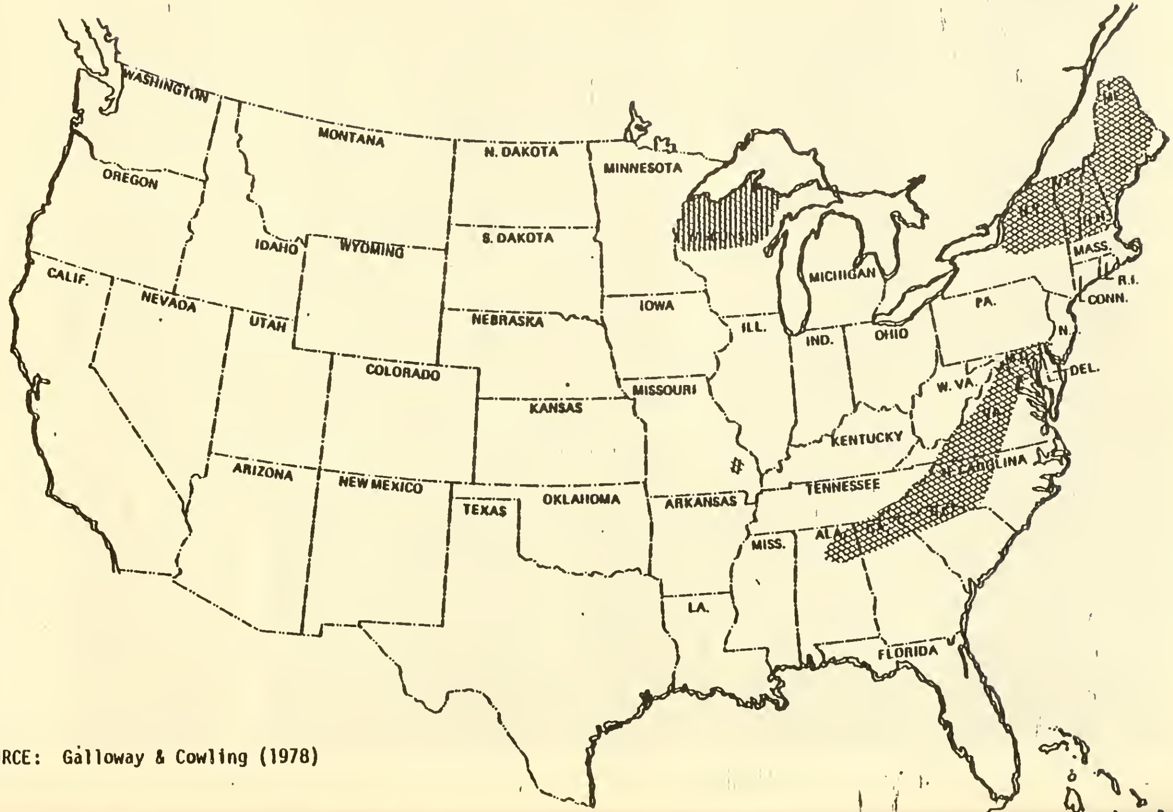
Based on current practices, for most people in the continental United States, there is likely to be little or no relationship between the quality of their tap water and acid rain. Acidic rain is substantially restricted to the Eastern U.S. (Munger and Eisenreich, 1983), where most people obtain drinking water from municipal systems drawing on surface water (Table 1). The route for these drinking water supplies passes through most of the compartments or micro-environments shown in Figure 1, which can alter water quality. If any of these compartments, including the municipal water treatment facility, results in neutralization of the water, then the mobilization of the Contaminants will likely be inhibited or previously dissolved Contaminants precipitated.

People with the greatest potential for exposure are those in sensitive areas (watersheds with minimal buffering capacity) who also receive drinking water from "short-circuit" routes. In particular, considering the patterns of water use in the Eastern U.S. (Table 1), the largest subcategory of households of concern would be those drawing drinking water from individual domestic wells in unbuffered watersheds. Unbuffered watersheds tend to be associated with regions having granite bedrock. Such sensitive areas are outlined in Figure 6. Within the areas indicated, some unbuffered watersheds can be found which may be adjacent to watersheds with adequate buffering capacity. In other words, not all of the outlined area is actually unbuffered. For example, Dr. Fuhs found that tap water from the Central and Eastern Adirondacks, in contrast to that from the Western slopes, did not exhibit elevated levels of lead or copper; whereas, all of the Adirondack region is indicated as potentially sensitive in Figure 6. Most of the sensitive areas are areas that tend to be relatively sparsely populated. For example, the major urban areas from Boston to Washington and around the Great Lakes are not in sensitive areas, while northern New England and the Adirondacks areas are sparsely populated. On the other hand, the rural populations found in sparsely populated regions are more likely to be served by individual domestic wells—a "short-circuit" route.

In order to get some perspective of the population living in the sensitive areas and served by domestic wells (i.e., a relatively high potential exposure group) the number of persons living in the shaded areas of Figure 6 was estimated by using county census data. This total was multiplied by 9%, which is the fractional volume shown in Table 1 as being withdrawn from groundwater in the Eastern United States for rural domestic use. The resulting number, about 0.5% of the total U.S. population, is probably on the high side because not all the shaded areas in Figure 6 are unbuffered. Another fraction of the population that is exposed to a "short-

FIGURE 6

PORTIONS OF THE U.S. WHICH CURRENTLY RECEIVE SIGNIFICANT RATES OF ACID DEPOSITION AND ARE POTENTIALLY SENSITIVE



SOURCE: Galloway & Cowling (1978)

circuit" drinking water route consists of those households which obtain their water from rooftop rainwater collectors. This fraction is unknown but probably very small. Thus, as an appropriate upper bound, the fraction of the U.S. population that constitutes a relatively high potential exposure group is about 0.5%.

For this group, though, the studies discussed above, as well as related literature, have not determined the incremental effect of acid rain, as opposed to other causes, on the levels of the Contaminants in their drinking water. That population might be exposed to similar concentrations even if the rain were "pristine." The reasoning behind this statement is complex and rests on many factors discussed earlier in this report, including the following:

- The complexity of the Pathway, even for well users, results in tap water quality being only weakly related to rainwater quality.
- Corrosion is a complex process which is not simply related to acidity.
- Even natural or "pristine" rain in known to be relatively corrosive (Galloway, et al., 1982).

Earlier in this paper, several arguments against the use of corrosion indices were noted. It is instructive to note here that "pristine" rain, as observed by Galloway, et al. (1982), at various remote locations of the globe, exhibits corrosivity that is "off the scale" of either the Langelier of Agressiveness indices. In one sense, this corroborates the concerns about use of the indices. In another sense, it indicates that rainwater, whether "acid" or not, is relatively corrosive. If soils and bedrock are unbuffered, then the resultant ground and surface waters will be soft, acidic, and relatively corrosive. The natural waters of sensitive areas (Figure 6) are like this and will probably continue to be corrosive regardless of the acidity of rainwater. Of course, it is reasonable to expect that acid rain may exacerbate this problem. But potable water supply systems in these soft water areas need be designed to accommodate this natural phenomenon, regardless of the outcome of the national debate over acid rain.

From this perspective, the following conclusion emerges: Lead pipe, and copper pipe with lead solder, should not be used in soft water areas such as the Adirondacks, unless the source water is neutralized. This standard operating procedure has been recognized by the plumbing trade for at least 25 years (Babbit, 1960). In the early 1950's, at a time when most scientists now believe rain was much less acidic, many lead service lines in New England were replaced with plastic pipe. Karalekas (1980) and Karalekas, et al. (1982), indicate that the optimum pH for control of lead pipe corrosion in the Boston system is above 8, a level higher than that typically found in the natural waters of New England.

The real question to be addressed is how much additional corrosion has occurred because of acid rain. Inferences drawn in several papers reviewed in this study that this pipe corrosion problem results predominantly from acid rain are not supported by the evidence presented.

In addition, the drinking water Pathway does not appear to be a major route of exposure to the Contaminants in the general population, and more information is needed on the relative importance of the Pathway for individuals in particular subgroups of concern (e.g., those in sensitive areas who receive their drinking water through a "short-circuit" route). At the present time, there is insufficient evidence to support a conclusion that acid rain produces or contributes significantly to adverse health effects by the indirect route of mobilizing the Contaminants in drinking water.

It should also be noted that any indirect health effects that may result from increased exposure to the Contaminants via the Pathway (whether or not attributable to acid rain) may well be mitigated as a result of compliance with federal, state, and local regulations affecting the quality of water in public water supplies. (See Appendix A.) Further, as pointed out above, in areas with naturally soft acidic water such as the Adirondacks, lead-containing plumbing materials should be removed or the source water should be neutralized by raising its pH or alkalinity, regardless of whether actions directed specifically at controlling acid rain are implemented. The impact of such mitigative measures should be included in any assessment of the risk of potential indirect health effects via the Pathway.

IV. RECOMMENDATIONS FOR NEEDED RESEARCH

To address the substantial information gaps and uncertainties apparent in the current state of understanding of this issue, several research efforts are recommended.

First, additional field data should be acquired to get a better perspective on the incremental effect of precipitation acidity on the concentrations of the Contaminants in tap water. In particular, tap water samples should be collected from homes serviced by lead and copper piping in areas of the U.S. which are similar to the Adirondacks in having soils and bedrock geology which naturally leads to soft water supplies (unbuffered, non-calcareous), but which receive significantly less acid deposition. Such a study would serve as a "control" study for comparison with the results of Fuhs et al., in the Adirondacks. It may be possible to locate such a "control" region in the Pacific Northwest. Although the bedrock geology of that region is principally recent volcanic rock, in contrast with the igneous bedrock of the Adirondacks, the two areas are similar in having a low natural supply of neutralizing capacity in their soils and bedrock, and, thus, naturally soft water.

In order to help predict incremental concentrations of the Contaminants resulting from acid rain, it would be desirable to conduct laboratory experiments on the mobilization of lead and copper from pipes and solder joints under variable conditions of pH, alkalinity, total solids, temperature, dissolved oxygen, etc. The conditions of the experiments would be controlled to simulate actual patterns of water use. It is possible that a comprehensive literature review, which was not attempted in this work, would provide some of this information.

Next, these data, other results which have been reviewed here, and perhaps other data available in the literature should be integrated and interpreted in order to support an estimate of the incremental contribution of the Contaminants to drinking water as a result of acid rain.

Finally, once the incremental effects of acid rain (in increasing concentrations of the Contaminants in drinking water) can be determined, and data have been collected on the numbers of persons exposed to defined levels of total and incremental Contaminant concentrations, a comprehensive risk assessment should be carried out. (Risk is defined here as the magnitude of the adverse health effects that might occur due to human exposure via the Pathway to Contaminants mobilized because of acid rain, considered in context with the probability that the effects will occur.) This would place the incremental human exposure to the Contaminants attributable to acid rain in perspective with other routes which lead to exposure to these Contaminants.

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APPENDIX A

REGULATORY FACTORS AFFECTING DRINKING WATER QUALITY

A significant amount of mitigation of potential adverse (secondary) health effects that may result from acid-rain-impacted water supplies may well derive from compliance with federal, state and local regulations controlling the quality of water in public water supplies. Local boards of health have control over private water supplies.

The Safe Drinking Water Act (PL 93-523) gave the U.S. Environmental Protection Agency authority to set: (1) Primary Standards--national, enforceable standards on pollutants known to be potential health problems; and (2) Secondary Standards--national, non-enforceable guidelines on pollutants and parameters which relate to aesthetics and/or potential health problems of a lesser degree.

The Primary Standards, which became effective in 1977, set maximum contaminant levels for several pollutants including lead (0.05 mg/l) cadmium (0.01 mg/L), and mercury (0.002 mg/l). States may set a lower standard. An initial set of Secondary Standards became effective 1981. These standards included suggested limits on other metals which may be present due (in part) to corrosion, e.g., iron (0.3 mg/l) and copper (1 mg/l). A suggested limit on pH was set at 6.5 to 8.5. And finally there is a specification that the water be "non-corrosive". Specific (quantitative) standards for corrosion control have not yet been developed because a universal corrosion indicator system to measure corrosion in all systems does not exist. It should be noted, however, that the U.S. Environmental Protection Agency is working on this problem and is considering amendments to the Primary Standards which would require identification and correction of corrosion problems (Fed. Reg. 44 (140): 42195, July 19, 1979). States may include an EPA Secondary Standard in their own (enforceable) State standards.

EXHIBIT H-1

Acid Rain and the Indiana Melon Crop

Congressman Francis McCloskey (In) noted in preliminary comments on H.R. 3400 that acid rain was associated with melon crop damage in southwestern Indiana. Public Service Indiana has included for this Subcommittee's information a report detailing probable causative factors for the 1983 melon crop damage (Benedict, Harris M. PhD, "Melon Damage in Southwestern Indiana 1983, Observations and Resulting Conclusions"). Dr. Benedict is an authority on air pollution effects on crops. He concluded that ozone was the cause of the melon damage. Sulfur dioxide was implicated by other investigators based on speculation, but Dr. Benedict found no sound evidence to implicate sulfur dioxide with the damage. There was no evidence to implicate acid rain as a causative factor.

EXHIBIT H-2

OBSERVATIONS OF AND RESULTING CONCLUSIONS AS TO THE CAUSE OF THE MELON INJURY IN SOUTHWESTERN INDIANA DURING THE SUMMER OF 1983

by

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OBSERVATIONS OF AND RESULTING CONCLUSIONS AS TO THE CAUSE OF THE MELON INJURY IN SOUTHWESTERN INDIANA DURING THE SUMMER OF 1983.

I. INTRODUCTION

Cantaloupe and watermelon growing in southwestern Indiana in 1983 suffered severe injury to the leaves and ultimately crop loss. The injury to the leaves was apparently noticed as early as June 21, (Heck 1983). This injury received more prominent attention as the result of damage to a cantaloupe field on June 29 near Patoka, Indiana belonging to Mr. Enos Ellerman. This damage was noted on June 29 following a severe thunderstorm. About two weeks later a more general rain hit the area and the injury then developed over most, if not all, of the melon growing area. Cantaloupes were the most severely injured but watermelons also developed symptoms. As a result of this injury the area was surveyed by individuals trained in the effects of various factors, including air pollution, on crops. As one of these individuals the author of this report was asked by PSI to survey the area and report conclusions. This is the report of those surveys and the conclusions drawn.

II. SUMMARY AND CONCLUSIONS

As a result of two visits to the Gibson and Knox County, Indiana area and review of data available on ozone and sulfur dioxide concentrations and along with weather records, the following conclusions were drawn. The primary cause of the injury was atmospheric ozone. This conclusion was arrived at primarily because the type of markings found on the melons and some weeds growing in the melon fields were typical of ozone injury. This was later at least partially substantiated when ozone levels recorded at Evansville showed that daily seven hour means, one standard often used for evaluating ozone effects on vegetation, approached .100 ppm for nearly seven days in a row and for periods of three days were above .100 ppm.

However, not enough is known about the sensitivity of the melons to ozone to know whether the exposure that existed was sufficiently strong to produce the amount of injury that occurred. Some investigators felt that it was not and suggested that other factors may be enhancing the amount of injury caused by the ozone. The possible enhancing factors suggested were atmospheric sulfur dioxide, the unusual climatic conditions and possible resulting edaphic factors that occurred during the months of June, July and August.

No sulfur dioxide markings were found on a known sensitive bioindicater for sulfur dioxide (giant ragweed) which was growing throughout the area of injury. Sulfur dioxide levels in the atmosphere more than three kilometers from a major source never exceeded the minimum levels generally reported to mark leaves of some 22 crop species and 18 forest species. It is concluded that atmospheric sulfur dioxide was the least likely factor to enhance the ozone injury, if such enhancement really occurred.

The climatic conditions occurring during the growing season have been unusual; heavy and continuous rains during the early part followed by unusually high temperatures and a long drought period. It seems more likely that these unusual conditions enhanced the effects of the ozone, if such enhancement was necessary.

A possible way in which the weather conditions could have affected the amount of injury is suggested below, although it is speculative.

III. FIELD SURVEYS

A. OBSERVATIONS

Two visits were made to the area, one on July 26 and 27 and the second on September 7-9. On the first visit in addition to looking at the fields some time was spent with Mr. Ellerman who described the cultural practices that melon growers generally follow. On the second visit Dr. Gary Reed of the USDA Agricultural Experiment Station at Vincennes described some of the special conditions that arose during 1983 which caused some alterations in the normal practices. The salient features of these discussions are given below as they form a background on which to base the observations and conclusions drawn.

According to Dr. Reed, the 1983 melon growing season was unusual and resulted in some variations from the normal procedures for fertilizing and caring for the melons. It is customary to fertilize the fields with 120 lbs. of nitrogen and phosphorous and 60 pounds of potash per acre. A thin plastic cover is put over the soil and the plants are then set through holes in the plastic. However, during the early stages of growth in 1983 there were heavy rains almost continuously and for the most part the plants did not develop at their normal pace. The growers felt that the relatively slow growth of the melons was caused by the rain washing away the fertilizer and many farmers made a second application. According to Dr. Reed, Enos Ellerman made a third application on the field that was damaged so badly after the thunderstorm. Following these extra fertilizer applications the rains stopped and unusually high temperatures and a drought period set in that lasted through June and July. The slow growth may have been due to lack of sunlight and heavily watered soil and not to the loss of the fertilizer. After the rains stopped, some of the highest temperatures on record occurred. These conditions may have had some effect on the ultimate growth of the crops. According to Dr. Reed, the symptoms seen on the injured leaves had been around for about 20 years and had been ascribed recently to downy mildew. Treatments for this disease were not effective in 1983 and this led to the search for another cause and the resulting surveys.

On July 21, Robert Steele of PSI visited the area and observed several fields with Enos Ellerman. On July 22 Dr. Walter Heck, who is Research Leader of the studies on the effects of air pollution on vegetation at North Carolina State and a leading authority on such effects, visited the area and submitted the report mentioned in the introduction to Dr. Gary Reed of the USDA Station at Vincennes. The conclusions drawn will be discussed later. Apparently his observations were limited to melon fields and weeds growing in the immediate vicinity of the melons including giant ragweed.

The first visit to the area was made on July 26 and 27, accompanied by Robert Steele and Wayne Swallow of PSI. The 26th was spent visiting the fields with Mr. Ellerman looking at melons but we also observed soybean fields, where readily available, and looked at some alfalfa plants and plantings of squash, cucumbers and eggplant. We also looked for markings due to sulfur dioxide on giant ragweed since it is emitted from the PSI Gibson Power Plant in the vicinity. During the second day of the visit, we flew by helicopter over the entire area being affected. From this vantage point it was only possible to distinguish the severely injured fields. This survey did show that the effect varied greatly from field to field and covered a wide geographic area.

As a result of the observations made on July 26-27, it was concluded that the injury was not due to sulfur dioxide. Based on the type and extent of the markings observed it seemed that ozone in the atmosphere was the probable cause. Although certain features of the observations did not completely support such a conclusion, (details of the observations made on July 26-27 are described in a communication of August 6 and will not be repeated here except for important features).

The principal findings in July were that cantaloupe in the area visited were severely damaged to the extent that in some fields the entire crop would be lost. Other fields showed much less damage or injury, so that a harvest could be made of the crop. Watermelons had or were developing similar symptoms but to a lesser degree and on occasion were also developing a chlorotic condition in the middle of the rows. This symptom also resembled ozone injury. Fields of cantaloupe were found southeast of the Gibson Power Plant where the amount of injury was much less than in the area north east of the power plant. One field in this area (at the site of the old Purdue experiment station), which according to Mr. Ellerman had been declared in No. "1" condition by Purdue examiners the week before our visit, had been severely injured, the leaves being severely marked and wilted. The grower told us that there had been a rain over the weekend and following the rain the injury had developed. We were later informed by Dr. Reed that the field had been suffering from lack of water. Thus a condition which should have relieved the stress apparently resulted in severe injury.

No sulfur dioxide-like symptoms were noted on any of the melons or giant ragweed plants examined. However, a field of sweet potatoes growing adjacent to Mr. Ellerman's melons did show intercostal markings on some leaves resembling those produced by sulfur dioxide. The percentage of these among the marked leaves was small. The other injured leaves resembled those produced by ozone.

Dr. Heck in his report stated that the symptoms observed were primarily due to ozone but that the severity could have been enhanced by many factors such as high soil moisture, age of planting, location on a slope instead of in bottomland and cultural practices such as the use of certain pesticides and the presence of sulfur dioxide or oxides of nitrogen from sources in the general vicinity, specifically mentioning the Gibson Power Plant.

On September 7, a meeting was held which included Dr. Heck and Dr. Richard Reinert of the USDA from North Carolina State University, Dr. Tony Endress, Illinois Natural History Survey, and myself as experts on air pollution effects on vegetation. Also at the meeting were representatives from PSI, Robert Steele and Wayne Swallow, representatives from the USDA Station at Vincennes and representatives from various departments of Purdue University. Dr. Bruno Moser, Chairman of the Horticulture Department at Purdue chaired the meeting. The purpose of this meeting was to recall the individuals who had observed the fields in July to reobserve the melons to see what had taken place in the meantime and have a brief meeting at the end of the day to see if some consensus could be arrived at among the four experts as to the cause. The meeting adjourned about 6:30 p.m. and everyone dispersed. The entire next day (September 8) was spent in observing melons, ornamental and native species and other crop species whose sensitivity to ozone and sulfur dioxide was known.

During the joint survey of September 7, only melon fields were observed and most of these were watermelons. The growth of the cantaloupes had generally been completed and many of the fields had been cleared. Special attention was paid to the growth that had developed since our visits in July. The survey began with the plantings at the USDA station at Vincennes where Dr. Heck had reported essentially no injury to melons or squash on July 22. We then visited a field across the road from the station where Dr. Heck had reported severe symptoms on July 22 (See Appendix C for a map of fields visited).

From this field and the Purdue station we preceded southward toward the Decker area looking only at melon fields and ended up at the Enos Ellerman field near Patoka where severe injury occurred on June 29. Particular but not exclusive attention was paid to markings found on watermelon leaves which were relatively free of markings when observed on July 26-27 or which had developed since that time. In most cases in the fields we observed this growth also showed the flecking, bronzing and silvering along with chlorotic and necrotic spotting all associated with ozone injury.

In Dr. Heck's report of his July 22 visit, it was indicated that the presence of sulfur dioxide from the power plants may have enhanced the amount of ozone type injury. Consequently, during the day, plants other than melons were continually observed for sulfur dioxide as well as ozone type markings. Sulfur dioxide type markings were occasionally pointed out on some weeds including wild morning glory which is also sensitive to ozone. At one location a specimen of velvet weed was found which had all the classical symptoms of sulfur dioxide injury. This was the only plant that fulfilled requirements for SO_2 injury.

However, the next day with Robert Steele and Mr. Kenneth Ellerman a large cluster of velvet weed plants was found which showed similar symptoms but also showed the range of markings that developed, from light to complete leaf injury coverage, as seen the day before. The initial symptoms were only on the perimeter of the leaf (classical fluoride) and spread inward as the intensity of the injury increases. This is the reverse of the development of sulfur dioxide injury on the leaves. The leaves were swarming with insects. For this reason, I do not believe the symptoms observed the previous day on one velvet leaf plant (Abutilon sp.) were due to sulfur dioxide.

Giant ragweed is well recognized as a bioindicator in the field of sulfur dioxide pollution. In spite of the fact that giant ragweed was present near almost every field observed on September 7; none of these plants had sulfur dioxide markings nor were any pointed out by other members of the party.

Following the severe damage to the Enos Ellerman field, Purdue University planted several varieties of cantaloupe in a small plot. These had made some growth since observed in July and the leaves showed the typical ozone markings seen on cantaloupe earlier. There was an appreciable difference between cultivars; some were damaged, others not so much.

The morning of September 8, accompanied by Robert Steele, soybean fields adjacent to the sulfur dioxide recorders at Schrodt, E. Mt. Carmel and Old Indian (locations with some of the highest SO_2 levels recorded in June and July) were examined for any markings that might be ascribable to sulfur dioxide (See Appendix B-1). No markings were found on any of the soybeans at any of these locations which could be ascribed to sulfur dioxide. Giant ragweeds plants were also present at these locations and they too were free of sulfur dioxide markings. Also in the morning we looked at various pine trees in the city of Mt. Carmel and at other locations where such trees had been seen the day before or in the earlier visit to the area within the territory where the melons had been injured. We also observed other ornamental plants for markings that might be ascribed to sulfur dioxide or ozone. None of the pines, regardless of species, showed any needle tip die back or mottling that is produced by ozone or sulfur dioxide. Some time was also spent in the Beal Woods Conservation Area looking at native trees for any evidence of pollution injury. The trees examined ranged in sensitivity from most sensitive (white ash) to intermediate (sweet gum and tulip tree) to resistant (white oak). Some twenty species were examined and none of them showed markings ascribable to ozone or sulfur dioxide. The trees were suffering from drought, however.

In the afternoon of September 8, we were accompanied by Mr. Kenneth Ellerman to some watermelon fields (J. Ellerman) which showed the yellow centers of the row seen earlier and had been sprayed for mites. The new growth in this field did not show the ozone type markings that we had seen in the melon fields visited the day before. We visited other fields that had been similarly treated, namely those of Denmann, Hume, and C. Ellerman. One of these fields had been observed the day before but the group had only viewed the area close to the road and had not gone through the length of the field. These fields or the parts of the fields observed on September 8 did not have near the amount of markings ascribable to ozone that were seen on the fields examined the day before. However, there were ozone markings present. These observations would indicate that perhaps other factors were contributing to the injury. The next morning we went to the first field with Dr. Gary Reed. He showed us that the plants had earlier been afflicted with ozone damage based on strings of dead leaves along the stems. However, he did say that he could show us many fields in which growth had occurred since our July visit and were free of the markings ascribed to ozone. This would seem to indicate that ozone effects had not been so severe as during the time preceding our July visit and that some fields may have escaped injury. In studying this phenomenon in later years care must be taken to insure that other factors are also controlled. The markings observed in some of the fields were definitely ozone; this means that the pollution effect was still present.

During the afternoon in addition to the melon fields we examined some ten pine trees including an eastern white pine on the P. Oexman estate. These were free of needle tip die back and mottling. We also observed some white petunias at the Carl Ellerman home along with some zinnias. These species are sensitive to ozone and SO_2 respectively. The specimens examined were, however, not of the most sensitive varieties. In any event they were free of ozone and sulfur dioxide markings.

Finally, we visited the estate of Dr. Roher where there was an alfalfa field. Alfalfa is one of the most sensitive plants known both to ozone and sulfur dioxide. The field had recently been cut, however, a few plants along the edges had been missed. These plants were about 8 to 10 inches high and had not reached blooming stage, so were in about the most sensitive stage of growth. No ozone or sulfur dioxide markings were found.

B. CONCLUSIONS

Following the field survey on September 7, the group met in the conference room of the USDA station at Vincennes and Dr. Heck, Dr. Reinert, Dr. Endress and Dr. Benedict were asked to give their opinions as to the cause of the markings based on our observations on that day and during our visit in July. Dr. Heck was of the opinion that the primary agent was ozone but added that he felt that the intensity of the injury was enhanced by the presence of sulfur dioxide in the atmosphere. It is recognized that if concentrations are right the presence of sulfur dioxide can increase the amount of ozone injury that develops. Dr. Heck also mentioned that the unusual temperatures and drought conditions also probably contributed to the severity of the injury. They all agreed as a result of their July observations that this was one of the most severe cases of defoliation ever observed.

When such enhancement of ozone effects by sulfur dioxide occurs plants of species sensitive to sulfur dioxide will usually develop sulfur dioxide type markings. Dr. Heck seemed to feel that there was sufficient evidence based on his work with T.V.A. and laboratory studies, to justify his feeling that sulfur dioxide enhanced the injury from the markings he had seen on the leaves of both crops and weeds.

In his discussion of the problem Dr. Heck suggested that in the next year, in order to study the problem further, that some thirty fields of melons strategically located in relation to sulfur dioxide sources be planted for close observation and that in these melon fields bioindicator species for both ozone and sulfur dioxide be planted. It was also felt that a recorder of both ozone and sulfur dioxide and possibly oxides of nitrogen be established in the center of the melon growing area so more appropriate data on the concentrations of these gases in the area be available.

Dr. Reinert and Dr. Endress essentially agreed with Dr. Heck.

All agreed that ozone was the primary agent in the production of the injury primarily because the type of markings observed both on the melons and on some of the weeds were so typical of ozone effects and also because the markings developed on the regrowth after the July visit were also of the ozone type. This conclusion was drawn in spite of the fact that many other features associated with ozone injury were not occurring. These will be discussed later. All also felt that the future studies proposed by Dr. Heck seem desirable but that some controlled fumigation studies should also be conducted.

However, Dr. Benedict could not agree that the evidence was strong enough to warrant the conclusion that sulfur dioxide was enhancing the amount of injury that was occurring. It should be pointed out that all of the conclusions were based primarily on the results of visual observations. At that time there was only available PSI's sulfur dioxide concentrations for June and ozone data for June and July from Evansville which showed only the hours during which the concentrations had been over 0.10 ppm. Since that time the PSI sulfur dioxide recordings for June, July and August have become available, along with the hourly ozone concentrations from two locations in Evansville for the months of June, July and August. These data are shown in Appendices A&B, along with a map showing the location of the sulfur dioxide recorders relative to the power plant and melon fields.

The reasons for questioning the enhancement of the ozone injury by sulfur dioxide were as follows. Giant ragweed is an acknowledged sensitive bioindicator for sulfur dioxide. In the July and September surveys no sulfur dioxide type or injury was found on these plants and no such injury was ever pointed out by others on the survey.

In his observations in July, Heck mentions that in one field he observed classical SO_2 symptoms on cantaloupe but saw no SO_2 symptoms on giant ragweed. He then adds that if the concentration of SO_2 was sufficient to injure the cantaloupe, he should have seen SO_2 injury on ragweed. The failure to observe sulfur dioxide injury on giant ragweed was not due to lack of experience in seeing such injury. Surveys of vegetation effects in the vicinity of power plants and other sources of sulfur dioxide have been made in other parts of the Ohio Valley from 1956 to date and markings due to this gas have been observed often in this area on giant ragweed, alfalfa, red clover, dwarf zinnias and other sensitive species. If the leaves of giant ragweed had developed sulfur dioxide injury they would have been noted. Furthermore no SO_2 injury was found on soybeans even at locations within a mile of the Gibson plant where sulfur dioxide levels were far greater than those that existed three miles from the plant. In two instances alfalfa fields were found within the area of the melon damage and no SO_2 markings were found on these plants.

IV. ATMOSPHERIC CONCENTRATIONS

A. SULFUR DIOXIDE

In addition to the visible observations of the vegetation PSI has ten SO_2 recorders located around the Gibson Power Plant (Appendix B-1). The location of some of these sites was selected on the basis of modeling results conducted using EPA models. PSI then added some additional recorders at greater distances from the plant based on a model that PSI believes is more accurate. The location of these monitors are shown in Figure 1 of the Appendix as to direction and distance from the stacks. The highest, second highest and average concentration over the June, July and August period for running durations of one, two, three, four, eight, and 24 hours are all shown in Table 1. One location was omitted, which is southwest of the power plant. (No sulfur dioxide level recorded at this location was higher than any shown in the table and the location is situated away from the melon area.)

TABLE 1

The highest, next to the highest and the average concentrations of SO_2 of various exposure times during June and July in 1983, at various locations around the Gibson Power Plant.

Location and	Exposure Times In Hours					
Exposure Type	1	2	3	4	8	24
Riverbank	1.7KM SW of Gibson Plant					
Highest	.597	.451	.377	.329	.228	.086
Next to Highest	.202	.177	.143	.111	.068	.028
Mean	.031	.025	.020	.019	.013	.005
Lakeview	1.9KM SSW of Gibson Plant					
Highest	.370	.343	.298	.262	.192	.083
Next to Highest	.279	.215	.178	.142	.078	.033
Mean	.038	.031	.027	.023	.017	.008
Tower	2.0KM SE of Gibson Plant					
Highest	.398	.346	.313	.275	.167	.067
Next to Highest	.188	.126	.100	.080	.045	.018
Mean	.030	.023	.021	.018	.011	.005
Schrodt	6.0KM West of Gibson Plant					
Highest	.571	.371	.262	.206	.115	.046
Next to Highest	.239	.186	.172	.152	.090	.034
Mean	.038	.030	.025	.020	.014	.007
Mount Carmel	2.9KM North of Gibson Plant					
High	.530	.392	.345	.301	.201	.079
Next to Highest	.202	.132	.125	.122	.071	.026
Mean	.034	.026	.022	.019	.013	.006
Scott Ditch	6.9KM SSE of Gibson Plant					
Highest	.193	.155	.127	.095	.074	.029
Next to Highest	.191	.129	.119	.096	.072	.030
Mean	.033	.028	.023	.019	.013	.007
SR 65	6.9KM ESE of Gibson Plant					
Highest	.256	.164	.124	.111	.067	.026
Next to Highest	.161	.096	.064	.048	.025	.010
Mean	.026	.020	.016	.014	.009	.006
East Mt. Carmel	2.9KM NNE of Gibson Plant					
Highest	.458	.230	.224	.120	.088	.033
Next to Highest	.364	.274	.202	.169	.096	.033
Mean	.052	.037	.032	.017	.017	.008
Old Indian	5.5KM NE of Gibson Plant					
Highest	.332	.217	.156	.165	.111	.043
Next to Highest	.293	.204	.154	.116	.060	.029
Mean	.061	.045	.035	.030	.019	.009

In reading the table, using the Riverbank site as an example, the highest one hour concentration was .597 ppm, the second highest one hour reading during June through August was .202 ppm and the average one hour readings for the three months was .031 ppm. The two hour level is the mean of the highest one hour reading and the higher of the two hourly readings just preceding or just following the highest one hour reading for that particular day. The same procedure is followed in determining the highest running averages for the three, four, eight, and 24 hour readings. The last one, is of course, the daily average.

In the great majority of cases when the one hour concentration was the highest the 2,3,4,8 and 24 hour averages were also the highest. There are a few exceptions in which the one hour concentration was not as high as that on another date but it was maintained for a longer period of time so that the two hour or longer averages were higher than those in which the one hour reading was the highest. When this occurred the highest average was given in the table since the primary interest is on duration and concentrations which might mark the plants.

Of the locations used, the Gibson Power Plant, the East Mt. Carmel and the Old Indian monitoring sites are almost in a direct line toward the town of Decker in Knox County. Decker is in the melon injury area.

These recordings always show that the highest sulfur dioxide levels occurred at the recording sites less than three kilometers from the plant, while the levels at 5.5 kilometers or more from the plant are much lower.

The levels at the Schrodt location are an exception. This recorder is located about 6 km west of the power plant and in the direction away from the melon fields. The concentration levels found at this location will be discussed in detail later.

The Federal Air Quality Standards for sulfur dioxide are 0.50 ppm for three hours, not to be exceeded more than once a year (this is designed to protect vegetation), 0.12 ppm for 24 hours and 0.03 ppm as an annual average. At none of these sites were the three hour and 24 hour standards exceeded during June and July and the three monthly averages never exceeded the 0.03 yearly standard.

Although the Air Quality Standards have all been met, the important thing is whether or not some of the levels reported could have injured vegetation, especially in the direction from the plant to the area of injury. In 1977, Dr. J. Jacobson (1977) reviewed the literature on concentrations of sulfur dioxide that had been found to injure vegetation or mark the leaves. In the paper he delineated the minimum concentrations at which injury to leaves had been reported to occur. He then delineated the maximum concentration at which no injury had been reported to occur. This left an area between the two levels in which injury might or might not occur. For the lowest concentrations known to produce injury he used the results of Dreisinger and McGovern (1970) obtained near Sudbury, Canada, in the vicinity of a large nickel smelter. These workers, in a study conducted over a five-year period, compiled a record on 22 crop species and 17 forest species of the minimum concentrations at which markings on vegetation was found to occur with exposures for one, two, four and eight hours. In their paper, the authors developed general levels at which to be fairly certain no injury to plants in the Sudbury area would occur and indicated that ground levels should never exceed the following:

1 hour	2 hours	4 hours	8 hours
0.70 ppm	0.40 ppm	0.26 ppm	0.18 ppm

They further listed the lowest concentration at which SO_2 markings had ever been found for each individual species with which they worked. The levels and the species are shown below.

	1 hr.	2 hrs.	4 hrs.	8 hrs.
Crops	0.46 bean	0.39 buckwheat	0.24 barley	0.12 barley
Forest	0.41 larch	0.34 bracken fern	0.25 white pine	0.13 aspen
Cucumber	1.08	0.79	0.50	0.25

(The numbers above are in ppm.)

Melons were not included in the study but cucumbers, which are in the melon family (Cucurbitaceae) were included and seemed fairly tolerant of sulfur dioxide. Markings usually did not develop at the above levels but when they did the amount was about the minimum detectable.

The sulfur dioxide concentrations actually found in the vicinity of the Gibson Power Plant (Table 1) exceeded the general levels given above only at the highest concentrations at exposures of two, four, and eight hours at the Riverbank site, exposures of two and four hours by the highest level at the Lakeview site and of four hours at the Tower site. These are all locations less than three kilometers from the power plant. However, at these locations the next to the highest levels never exceeded the general levels at which vegetation in general might be affected.

All the levels, including the highest, at the other locations including SR 65, East Mt. Carmel and Old Indian not only did not exceed the general levels but were much below them.

If comparisons are made between the SO_2 concentrations for one, two, four, and eight hours for specific crops as given by Dreisinger and McGovern none of the concentrations at any location from the next to the highest on down would have marked even the most sensitive plants which they studied, whether crop or forest species.

Also at locations more than 3 kilometers from the Gibson plant none of the levels recorded, including the highest, would have marked these most sensitive plants. The levels recorded at the Schrodt site are an exception in the following manner. The highest levels recorded at this station never exceeded the general levels which Dreisinger and McGovern indicated would usually have to be exceeded to mark vegetation. However the highest one hour level recorded 0.571 ppm would cause slight markings on only two of the 22 crop species and 8 of the forest species they studied. The 2, 4 and 8 hour average concentrations were not high enough to mark any of the species.

The high level at Schrodt occurred on August 26 about 13 days before our survey on September 8. There were two fields of soybeans of different ages and some giant ragweed all within thirty feet of this recorder. On none of these plants were any markings ascribable to sulfur dioxide found. If the plants had been marked when that high level occurred those markings would have still been present when we observed them.

Thus, over the three month period of June, July and August, exposures of sulfur dioxide which would have marked plants occurred on only one day and then only at locations within three kilometers of the stacks. At locations 5.5 kilometers or more from the stacks, none of the doses would have marked even the most sensitive plants which Dreisinger and McGovern studied. It should be remembered that the closest melon field to the Gibson Power Plant was about twice as far away as the farthest monitoring site. Thus, by the time the air mass reached the fields the concentration would have been much further reduced. On the basis of these results, it is not surprising that no sulfur dioxide type markings were found. This, of course, assumes that other sources of sulfur dioxide in the area did not make significant contributions to the SO_2 in the area. However, the size of the other sources compared to the Gibson Power Plant are relatively small so that the fields would have to be very close to them to be affected.

It has been argued that sometimes the plume from a plant skips long distances from the stack without suffering the usual dilution and then suddenly descends and injures vegetation without affecting any plants in between this area and the source. This condition generally arises during unusual meteorological conditions such as thunderstorms. The injury during a hurricane near Mt. Storm, West Virginia is often cited as an example. Personal experience in the Ohio Valley has indicated that this type of distribution may occur about once in every five years. It also occurs around large single sources in the western United States. However, when this happens the area affected is very limited, usually two to four farms or one square mile at the most, and not areas that extend for thirty or forty miles long and some miles wide.

A limited literature search for papers describing responses of watermelon or cantaloupe to sulfur dioxide yielded only one. O'Gara in the 1920's fumigated cantaloupe in Utah and found the variety he worked with to be in the resistant group about 7.7 times as resistant as alfalfa or barley. (See Magill, Holden & Ackley 1956). Among the forest species studied by Dreisinger and McGovern were eastern white pine and red pine. They reported these trees being marked at 0.45, 0.35, 0.25 and 0.21 ppm of SO_2 after one, two, four, and eight hours of exposure, respectively. A limited number of trees of these species were observed during the visits in July and September but no SO_2 markings were found.

Thus, based on the following, the evidence does not support the conclusion that sulfur dioxide in the area is enhancing the injury done to the melons by the ozone:

1. No sulfur dioxide type markings were observed on recognized bioindicators such as giant ragweed and alfalfa within the area where the melons were injured.

2. Sulfur dioxide exposures, between the Gibson plant and the melon growing area except for locations within three kilometers of the Gibson Plant, were all considerably below the minimum concentrations that other workers have found to produce such markings on even the most sensitive plants.

B. OZONE

This raises the question then; is the concentration of ozone in the atmosphere high enough to cause the rather severe injury seen on the cantaloupes and on the watermelons during the time they were growing?

Almost nothing is known about the sensitivity of these plants to ozone. In the early 1950's, evaluations were made by five workers in the Los Angeles area as to the sensitivity of cantaloupe to Los Angeles smog, of which ozone is the major plant injuring component. All five individuals classed them as resistant. (Magill et al 1956) In a phone conversation with Dr. Ron Oshima of the California Dept. of Agriculture I learned that cantaloupe are not injured by the ozone levels presently existing in the San Joaquin Valley.

However, Gausman et al. (1978) in Weslaco, Texas fumigated eight week old plants of cucumber, cantaloupe cv perlita, cowpea, sweet pepper, squash, lima bean, pinto bean and watermelon cv. Charleston gray at 0.16 ppm of O_3 for two hours, in plexiglass chambers. (This is obviously not under field conditions.) They found that cucumber, cantaloupe and cowpeas were marked more than any of the other species.

This would indicate the cantaloupe are more sensitive than watermelon. This would agree with the observations reported here. These results do indicate that cantaloupe grown in the more humid areas of Texas may be more sensitive than those grown in arid California. Gausman et al. went on and developed a method of detecting ozone injured cantaloupe through a remote sensing technique from the air.

No ozone concentration measurements were made within the area of melon injury. Readings were made at two locations in Evansville which is about forty miles from the injured melons. (Appendix A) The results show that from June 21-26, or for six days, the seven hour average (9:00 a.m. to 4:00 p.m.) averaged 0.085 ppm and that for three of these days the average of the seven hour means was .096 ppm. The range for the six days was from .075 to .104 ppm with hourly readings as high as .110 ppm. This was just a few days before Enos Ellerman recorded his loss near Patoka, Indiana. From July 8 to July 14 the seven hour daily means averaged .096 ppm and ranged from .085 to .108 ppm. Hourly readings were reported as high as .129 ppm. During one three day period; the seven hour means averaged .105 ppm. I visited the area on July 26 and 27 about 10 days after the high levels were recorded and

Dr. Heck visited the area about one week after the high levels occurred. Following July 25 through August there were no prolonged periods of high ozone levels; most of the seven hour means ranged between 0.050 and .080 ppm with three days reaching .90 ppm, using the Scott school data. The seven hour means for August averaged .068 ppm.

Because of the lack of knowledge of melon sensitivity it is really not possible to estimate whether such exposures would result in the amount of injury we observed in the field. However, an exposure for six days, or 42 hours, at .085 ppm is equivalent to 3.4 ppm-hrs and for seven days at .096 ppm is equivalent to 4.7 ppm-hrs. Tables in the 1978 Ozone Criteria Document, in which visible effects received the most attention, show exposures of about .5 ppm-hrs were producing 50 percent leaf loss on sensitive and .6 ppm-hrs were producing about 30 percent leaf injury on intermediately sensitive plants. It is not impossible that exposures seven to eight times as high could kill 80-90% of the leaf area. On the other hand, if the plants are as sensitive as the studies of Gausman et al. indicate then even more severe injury could occur. This is, of course, speculation and until controlled fumigations as close to field condition as possible are conducted, there is no way to be certain of what exposures are required.

V. DISCUSSION

As far as the interaction between ozone and SO_2 in causing foliar injury changes (additive, synergistic, or antagonistic), until some controlled experiments are conducted, any conclusions would again be speculative. It is risky to make comparisons between different species as to their reactions to the same exposure of ozone or ozone and SO_2.

If it is felt that the ozone exposures alone cannot account for the extent of the damage and since the evidence seems to indicate that the SO_2 present will not affect the plants, there is another possibility which should be considered although not much credence has been given to it so far. As noted earlier, it was the general practice of the growers in 1983 because of the early heavy rains to reapply the regular amount of fertilizer used. Enos Ellerman made two additional fertilizer applications. The growers seemed to feel that the rain had washed out the regular application because of the slow growth the plants were making. This slow growth according to Dr. Gary Reed could have been due to the lack of sunlight and the water saturated soil. In reviewing the dates in June and July when the high ozone levels occurred, it is found that they both occurred before heavy rains, following which the damage to the melons was noticed on June 29-30 by Enos Ellerman and again around July 15-16 over a wider area. It is possible that the high ozone concentrations had weakened the plants and started the development of the ozone symptoms, then when the rains came (following a period of drought and high temperatures) all those nutrient salts in the ground suddenly became available and were taken up by the plants producing the heavy necrosis seen on the leaves. This type of injury is often found on overfertilized ornamental plants and commonly occurs with alfalfa in the irrigated areas of western United States.

This brings to mind the melon field at the old Purdue experiment farm which had been in good condition, though perhaps drought stressed, a few days before we visited it. A heavy rain had occurred in the meantime and a condition which should have relieved the stress seemed to have instead severely damaged the plants. The triple fertilization by Enos Ellerman might explain why his field suffered such severe damage, while those to the southwest were not injured. They did not get the rain at that time. It is interesting to note that during June 29 the winds generally varied from the south east to slightly west of south (141 to 198 degrees) except for one hour when the winds were from the east south east (111 degrees). Thus the winds during that period were not blowing from the Gibson plant toward the Ellerman field. For the wind to blow from the Gibson plant toward Ellerman's field it would have to come from a westerly direction (i.e. 270 plus or minus 25 degrees).

It is the author's opinion, that if it is necessary to look for factors which would enhance the injury caused by the unusually high ozone, the unusual weather conditions that occurred during the year, which may have helped build up the high ozone, are much more likely candidates than the sulfur dioxide which was present. The possibility of sulfur dioxide adding to the amount of ozone injury either synergistically or additively cannot be completely ruled out. However, from what is known about the sulfur dioxide concentrations in the area and the absence of sulfur dioxide markings on a known sensitive bioindicator, this is the most unlikely of the possibilities.

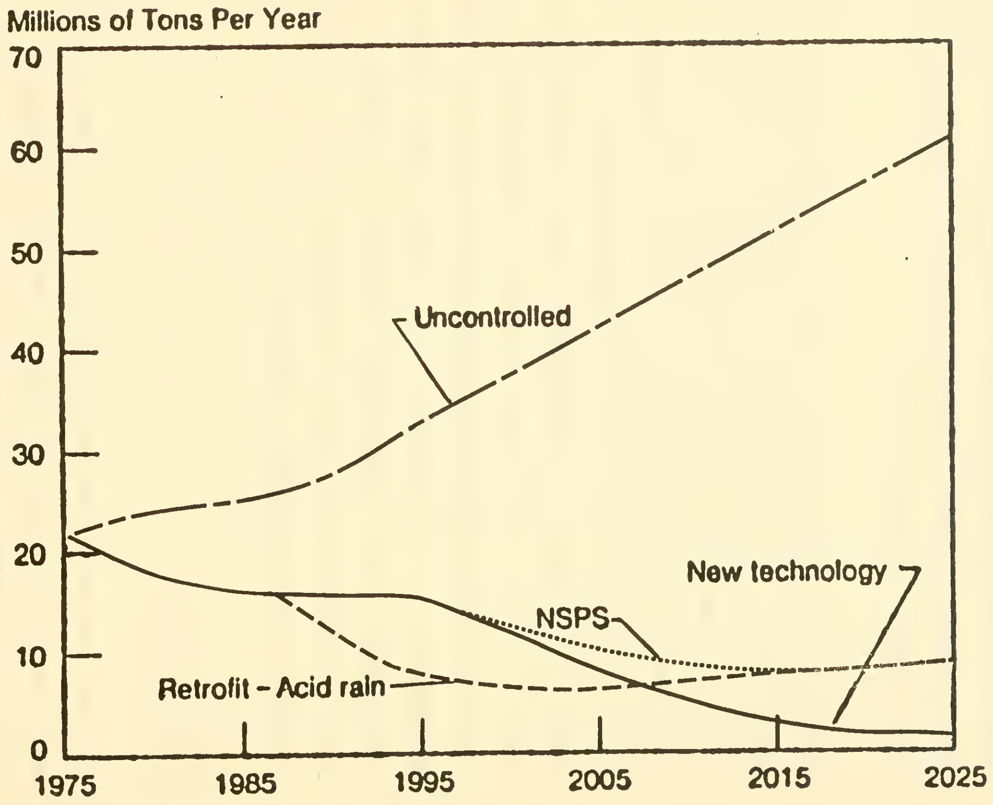
The general consensus among the individuals who surveyed the area is that ozone is the primary factor responsible for the melon injury. There are features about the event that do not fit into such an interpretation. Thus, the injury as far as observed, was confined solely to crops and weeds growing in cultivated soil. It is possible that cultural practices have enhanced the sensitivity of the crops. However, there are native and ornamental plants growing in the area which should have been affected if the ozone level was sufficient to mark melons. Yet in looking for such injury, none could be found. Eastern white pine and red pine are examples. It must be noted that white pine has individuals that are sensitive and tolerant and it is possible, that we observed only the tolerant ones.

VI. RECOMMENDATIONS

The above review of the melon injury around Vincennes indicates that there are gaps in our knowledge as to the ultimate cause of the injury. The review stresses the importance of conducting some field studies to fill in those gaps. The studies suggested by Dr. Heck should be completed as far as is possible. However, there may be difficulty in finding soil types suitable for melon growth near the

EXHIBIT 21

UTILITY SO_x EMISSION TRENDS



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APPENDIX A

HOURLY OZONE CONCENTRATIONS, JULY, JULY AND AUGUST, 1983

Page .

Less than 24-hour sampling interval [1]

City
Agency
Evansville IN

City Name
Scott School

Site Address
Ambient Air

Project

ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

Ozone
Parameter observed

One Hour
Time interval of obs.

Chemiluminescence
Method

Parts per million
Units of obs.

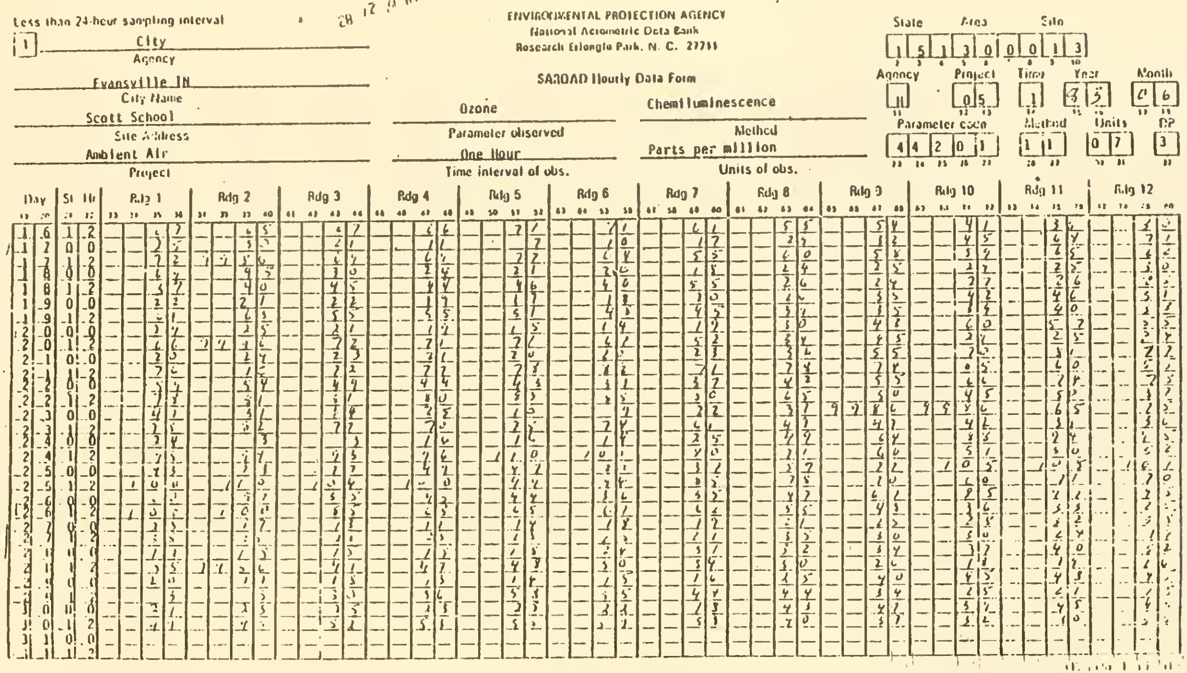
State 1 5 | Area 1 3 0 0 | Site 0 1 3

Agency H | Project 0 5 | Time 1 | Year 8 3 | Month 0 6

Parameter code 4 4 2 0 1 | Method 1 1 | Units 0 7 | DP 3

Day	St Hr	Rdg 1	Rdg 2	Rdg 3	Rdg 4	Rdg 5	Rdg 6	Rdg 7	Rdg 8	Rdg 9	Rdg 10	Rdg 11	Rdg 12
01	00	21	12	9	7	7	5	15	32	37	45	46	35
01	12	41	47	45	44	30	48	20	30	28	34	12	13
02	00	20	12	17	15	15	19	24	36	41	36	34	34
02	12	36	35	44	43	43	32	31	35	35	32	31	35
03	00	24	12	29	33	10	46	40	41	16	34	35	46
03	12	17	56	51	50	57	50	41	30	24	24	25	46
04	00	40	35	31	14	31	30	32	39	44	40	60	61
04	12	62	60	59	52	32	31	40	25	15	21	22	25
05	00	27	31	30	24	14	15	26	36	42	57	64	69
05	12	71	69	71	24	76	61	51	41	38	45	40	43
06	00	41	45	40	34	34	32	29	27	26	34	30	52
06	12	31	9 9 86	42	42	37	30	37	30	10	30	24	21
07	00	19	14	20	23	20	15	20	16	23	30	46	41
07	12	30	53	50	52	50	49	45	26	15	15	24	21
08	00	33	30	31	26	24	26	25	34	43	50	52	52
08	12	50	9 9 16	42	52	64	60	50	26	10	9	15	15
09	00	20	31	17	15	11	15	21	39	35	62	62	72
09	12	72	84	16	81	16	76	62	51	48	56	50	36
10	00	45	38	47	32	26	40	27	34	42	64	27	77
10	12	51	9 9 36	52	87	90	90	88	66	45	40	26	24
11	00	36	32	21	22	30	20	24	30	41	60	75	32
11	12	21	87	21	47	82	76	70	66	26	42	40	56
12	00	32	11	11	35	14	34	30	42	45	60	51	67
12	12	55	10	69	60	82	54	77	65	50	44	41	46
13	00	36	12	29	30	30	37	10	31	40	66	24	73
13	12	54	50	51	51	16	51	61	66	55	5	52	47
14	00	43	35	14	14	30	30	10	34	48	65	77	52
14	12	23	25	4 2 66	15	61	61	14	50	48	42	40	31
15	00	31	36	32	22	21	15	14	12	20	34	44	41
15	12	41	36	54	55	60	40	47	41	38	12	21	12
16	00	6	14	14	4	2	3	5	[illegible]	3	56	65	65

Ozone, Scott School (site 013) June, 1983 p.1



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ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

Less than 24-hour sampling interval [1]

City
Agency

Evansville IN
City Name

Scott School
Site Address

Ambient Air
Project

Ozone
Parameter observed

One Hour
Time interval of obs.

Chemiluminescence
Method

Parts per million
Units of obs.

State 1 5 | Area 1 3 0 | Site 0 0 1 3

Agency H | Project 0 5 | Time 1 | Year 8 5 | Month 0 6

Parameter code 4 4 2 0 1 | Method 1 1 | Units 0 7 | DP 3

Day | St Hr | Rdg 1 | Rdg 2 | Rdg 3 | Rdg 4 | Rdg 5 | Rdg 6 | Rdg 7 | Rdg 8 | Rdg 9 | Rdg 10 | Rdg 11 | Rdg 12

Page 1

Less than 24-hour sampling interval [1]

ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

City: Evansville IN (Agency)

City Name: Scott School

Site Address: Ambient Air

Project

Parameter observed: Ozone

Time interval of obs.: One Hour

Method: Chemiluminescence

Units of obs.: Parts per million

State	Area	Site	Agency	Project	Time	Year	Month	Parameter code	Method	Units	DP
1 5	1 3 0 0	0 1 3	H	0 5	1	8 3	0 7	4 4 2 0 1	1 1	0 7	3

Day	St	Hr	Rdg 1	Rdg 2	Rdg 3	Rdg 4	Rdg 5	Rdg 6	Rdg 7	Rdg 8	Rdg 9	Rdg 10	Rdg 11	Rdg 12
01	0	0	--18	--75	--16	--32	--30	--27	---5	--13	--31	--51	--48	--50
01	1	2	--60	--65	9986	--69	--69	--73	--70	--64	--58	--49	--38	--31
02	0	0	--31	--31	--29	--24	--22	--21	--26	--31	--38	--46	--45	--43
02	1	2	--44	--41	--35	--50	--55	--47	--95	--39	--38	--26	--24	--25
03	0	0	--20	--12	--17	--22	--22	--15	--17	--18	--19	--18	--20	--22
03	1	2	--25	--26	--25	--34	--34	--35	--12	--35	--30	--28	--26	--25
04	0	0	--30	--22	--21	--54	--17	--19	--22	--18	--29	--30	--35	--37
04	1	2	--15	--15	--15	--30	--33	--28	--28	--25	--27	--27	--36	--26
05	0	0	--22	--31	--17	--15	--15	--14	--19	--25	--34	--40	--42	--41
05	1	2	--44	--44	9986	--45	--45	--47	--46	--42	--37	--32	--21	--72
06	0	0	--32	--31	--22	--26	--14	--15	--13	--35	--35	--38	--94	--51
06	1	2	--58	--52	--61	--62	--66	--70	--72	--45	--53	--46	--44	--41
07	0	0	--44	--44	--45	--41	--35	--20	--25	--57	--50	--57	--60	--60
07	1	2	--61	--65	--66	--71	--67	--65	--20	--50	--56	--56	--5[illegible]	--57
08	0	0	--50	--47	--42	--37	--31	--27	--34	--40	--51	--70	--82	--85
08	1	2	--70	--90	9946	--95	-101	--46	--74	--54	--91	--76	--3[illegible]	--29
09	0	0	--34	--40	--44	--58	--62	--48	--56	--51	--79	--91	--26	--95
09	1	2	-105	-116	-121	-136	-122	--16	--66	--71	-111	--70	-10[illegible]	--47
10	0	0	--34	--40	--80	--[illegible]5	--13	--17	--39	--51	--80	--90	--92	-106
10	1	2	-102	-111	-113	-116	-105	--47	--40	--96	--70	--71	--78	--54
11	0	0	--64	--65	--55	--64	--65	--19	--92	--52	--73	--84	--49	-102
11	1	2	-106	-183	-101	-100	-102	--19	--45	--32	--43	--82	--70	--87
12	0	0	--86	--51	--92	--60	--63	--42	--64	--42	--70	--25	--46	--87
12	1	2	--42	9916	--95	--71	--82	--75	--26	--62	--67	--58	--66	--40
13	0	0	--72	--49	--82	--31	--32	--24	--81	--42	--68	--81	--66	--99
13	1	2	-112	-115	-116	-115	-102	--98	--[illegible]	--80	--70	--24	--56	--40
14	0	0	--32	--31	--40	--20	--11	--[illegible]8	--[illegible]6	--75	--61	-105	-106	--71
14	1	2	--31	9936	--41	--82	--70	--60	--47	--45	--60	--56	--5[illegible]	--36
15	0	0	--35	--37	--23	--13	--21	--22	--35	--37	--59	--65	--65	--67
15	1	2	--64	9954	--67	--16	--55	--52	--40	--35	--51	--43	--3[illegible]	--37
16	0	0	--7[illegible]	--23	--52	--40	--30	--31	--17	--55	--71	--73	--25	--76

Ozone, Scott School (site 013) July, 1983 p.1

Less than 24-hour sampling interval [1]

City
Agency

Evansville Ill
City Name

Scott School
Site Address

Ambient Air
Project

ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

Ozone
Parameter observed

One Hour
Time interval of obs.

Chemiluminescence
Method

Parts per million
Units of obs.

State	Area	Site
1 5	1 3 0 0	0 1 3

Agency	Project	Time	Year	Month
H	0 5	1	8 3	0 7

Parameter code	Method	Units	DP
4 4 2 0 1	1 1	0 7	3

Day	St Hr	Rdg 1	Rdg 2	Rdg 3	Rdg 4	Rdg 5	Rdg 6	Rdg 7	Rdg 8	Rdg 9	Rdg 10	Rdg 11	Rdg 12
16	12	72	71	62	65	62	58	40	32	42	44	31	37
17	00	46	32	22	31	30	30	38	42	55	61	72	41
17	12	46	33	41	33	62	17	14	20	35	40	46	41
18	00	[illegible]	36	37	33	34	22	36	48	42	56	72	60
18	12	56	86	71	66	62	57	47	43	56	63	62	34
19	00	51	54	53	45	14	27	14	15	42	57	67	34
19	12	53	72	71	77	72	52	32	42	47	36	35	24
20	00	[illegible]	31	41	70	11	14	16	10	45	56	71	85
20	12	33	72	32	43	51	20	60	60	58	50	40	46
21	00	31	41	32	31	94	23	17	40	50	50	64	38
21	12	72	62	71	91	16	52	57	54	50	42	42	42
22	00	44	37	32	12	22	35	36	43	60	73	74	73
22	12	71	42	75	62	70	62	52	50	32	32	38	45
23	00	43	32	31	32	10	16	36	45	62	26	36	77
23	12	43	45	72	26	78	72	52	30	50	44	48	42
24	00	42	31	31	37	35	12	33	41	44	46	34	41
24	12	52	45	64	76	75	53	58	31	46	31	17	37
25	00	20	35	32	35	43	32	16	12	10	22	17	16
25	12	62	66	52	54	57	11	51	44	40	32	15	17
26	00	[illegible]	[illegible]	25	34	21	16	27	38	35	48	55	63
26	12	46	64	1246	63	34	45	31	30	42	[illegible]	53	71
27	00	42	[illegible]	42	34	12	32	18	34	47	22	65	12
27	12	11	[illegible]	44	71	71	71	60	40	40	31	74	15
28	00	26	31	34	22	35	12	32	31	47	57	60	24
28	12	71	71	73	28	74	26	70	63	50	46	42	46
29	00	41	36	42	42	45	12	71	40	51	54	61	47
29	12	[illegible]	46	71	21	71	62	62	31	45	46	42	35
30	00	31	26	33	34	40	10	38	53	36	51	61	60
30	12	61	56	23	71	77	71	66	51	32	74	30	22
31	00	41	16	32	36	15	13	26	31	37	75	50	56
31	12	47	57	56	66	22	72	52	71	62	54	48	47

(site 013) July, 1983 p.2

Less than 24-hour sampling interval

[1]

City

Agency

Evansville III

City Name

Scott School

Site Address

Ambient Air

Project

ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

Ozone

Parameter observed

One Hour

Time interval of obs.

Chemiluminescence

Method

Parts per million

Units of obs.

State	Area	Site
1 5	1 3 0 0	0 1 3

Agency	Project	Time	Year	Month
II	0 5	1	8 3	0 8

Parameter code	Method	Units	DP
4 4 2 0 1	1 1	0 7	3

Day	St Hr	Rdg 1	Rdg 2	Rdg 3	Rdg 4	Rdg 5	Rdg 8	Rdg 7	Rdg 8	Rdg 9	Rdg 10	Rdg 11	Rdg 12
01	00	——45	——44	——44	——48	——43	——40	——39	——37	——37	——35	——39	——49
01	12	——49	——50	9256	——56	——47	——45	——54	——50	——55	——48	——33	——32
02	00	——26	——39	——10	——16	——10	———3	———3	———6	——17	——39	——52	——65
02	12	——21	——25	——72	——79	——79	——77	——77	——20	——67	——62	——58	——53
03	00	——50	——50	——40	——43	——40	——26	——25	——19	——35	——42	——65	——90
03	12	——41	——86	——87	——57	——80	——76	——72	——15	——57	——60	——44	——32
04	00	——35	——16	——42	——56	——58	——50	——50	——43	——47	——42	——49	——62
04	12	——70	——78	——84	——67	——67	——86	——20	——54	——39	——31	——30	——27
05	00	——26	——45	——20	——15	——12	——60	——15	——35	——30	——30	——44	——51
05	12	——50	——37	——46	——42	9216	——81	——77	——75	——65	——55	——43	——95
06	00	——44	——40	——41	——39	——38	——39	——32	——45	——65	——76	——77	——78
06	12	——28	——72	——81	——79	——75	——70	——51	——53	——60	——63	——57	——51
07	00	——39	——32	——32	——39	——22	——23	——11	——45	——56	——67	——72	——75
07	12	——75	——75	——75	——55	——82	——70	——41	——50	——36	——45	——50	——75
08	00	——60	———3	———6	———9	——17	———9	——20	——22	——55	——74	——90	——96
08	12	—100	9436	—102	—100	——14	——77	——55	——55	——35	——37	——40	——39
09	00	——34	——25	——26	——35	——34	——34	——35	——30	——65	——70	——72	——81
09	12	——33	——33	——76	——72	——75	——84	——70	——60	——51	——92	——45	——40
10	00	——11	——35	——57	——15	——13	——26	——26	——11	——36	——55	——66	——70
10	12	9180	9155	——45	——91	——23	——90	——80	——72	——75	——22	——25	——80
11	00	——75	——65	——61	——58	——53	——50	——46	——45	——47	——52	——53	——56
11	12	——65	——45	——51	——50	——55	——25	——12	——50	——45	——31	——34	——27
12	00	——15	——16	———1	——12	——12	——16	———5	——17	——33	9286	——48	——50
12	12	——51	——56	——55	——58	——61	——68	——57	——46	——46	——42	——36	——27
13	00	——43	——17	——12	——32	——35	——24	——22	——31	——22	——32	——42	——67
13	12	——26	——72	——32	——86	——82	——82	——18	——58	——56	——66	——67	——65
14	00	——66	——66	——51	——46	——44	——40	——41	——41	——46	——48	——58	——81
14	12	——37	——11	——76	——96	——84	——45	——78	——82	——75	——65	——60	——60
15	00	——32	——15	——47	——12	——24	——30	——24	——34	——47	9986	——82	——76
15	12	——31	——14	—102	—105	—106	——95	——84	——65	——15	——76	——66	——42
16	00	——21	——25	——32	——79	——14	——18	——18	——27	——44	——66	——87	——88

Ozone, Scott School (site 013) August, 1983 p.1

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ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

Less than 24-hour sampling interval [1]

City
Agency

Evansville III
City Name

Scott School
Site Address

Ambient Air
Project

Ozone
Parameter observed

One Hour
Time interval of obs.

Chemiluminescence
Method

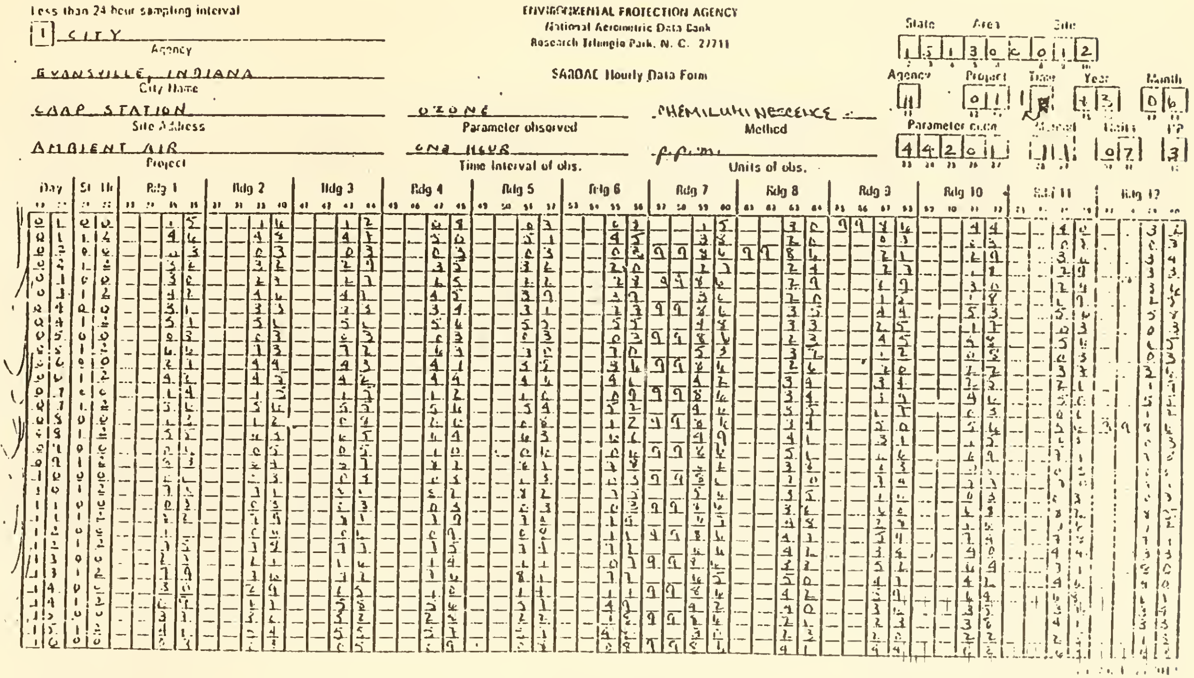
Parts per million
Units of obs.

State 1 5 Area 1 3 0 0 Site 0 1 3
Agency 11 Project 0 5 Time 1 Year 8 3 Month 0 8
Parameter code 4 4 2 0 1 Method 1•1 Units 0 7 DP 3

Day	St Hr	Rdg 1	Rdg 2	Rdg 3	Rdg 4	Rdg 5	Rdg 6	Rdg 7	Rdg 8	Rdg 9	Rdg 10	Rdg 11	Rdg 12
16	12	57	88	84	82	79	77	74	63	62	57	55	54
17	00	48	48	42	45	45	41	34	35	40	49	56	32
17	12	64	71	58	55	55	43	48	41	31	35	46	43
18	00	43	41	51	38	38	32	34	32	35	45	51	55
18	12	65	75	68	70	67	70	70	68	70	67	60	51
19	00	45	45	45	45	48	42	37	32	40	45	57	32
19	12	60	63	2 2 16	61	61	66	64	31	67	55	53	56
20	00	58	40	56	54	52	56	52	32	43	45	40	52
20	12	45	52	55	31	70	78	73	70	59	56	65	70
21	00	58	32	42	71	35	30	26	36	42	47	51	55
21	12	57	65	75	56	64	47	74	81	42	82	62	56
22	00	56	57	53	68	41	46	44	41	46	43	40	42
22	12	61	66	76	3	62	82	54	50	36	43	32	25
23	00	23	48	11	30	7	7	3	3	8	73	34	35
23	12	40	51	53	3	62	70	54	32	11	12	27	16
24	00	1	3	3	97	3	8	5	3	13	32	52	65
24	12	77	9 9 56	9 9 56	24	88	35	79	65	55	50	46	40
25	00	34	35	34	92	22	31	21	27	37	50	65	41
25	12	41	1 2	1 07	21	26	22	26	57	55	63	67	74
26	00	67	50	56	1 17	35	36	38	47	45	58	77	52
26	12	1 63	45	9 9 65	25	1 37	1 65	70	73	58	49	31	24
27	00	34	33	34	84	26	43	41	41	47	40	70	76
27	12	77	31	59	42	86	74	62	46	55	67	10	61
28	00	57	57	55	70	44	41	38	32	14	91	42	51
28	12	74	25	56	17	71	81	76	50	35	30	10	20
29	00	21	25	11	62	21	22	21	14	33	44	56	60
29	12	64	[illegible]	9 9 86	34	67	61	54	44	31	42	32	27
30	00	51	45	31	75	33	75	21	30	36	48	64	74
30	12	76	72	76	3	68	52	36	33	30	31	30	34
31	00	55	21	[illegible]	51	1	5	1	9	21	47	54	57
31	12	21	12	75	[illegible]	72	73	65	61	31	46	34	33

(site 013) August, 1983 p.2

PAGE 1



Less than 24 hour sampling interval

1 CITY

Agency

EVANSVILLE, INDIANA

City Name

CAAP STATION

Site Address

AMBIENT AIR

Project

ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

OZONE

Parameter observed

ONE HOUR

Time Interval of obs.

CHEMILUMINESCENCE

Method

p.p.m.

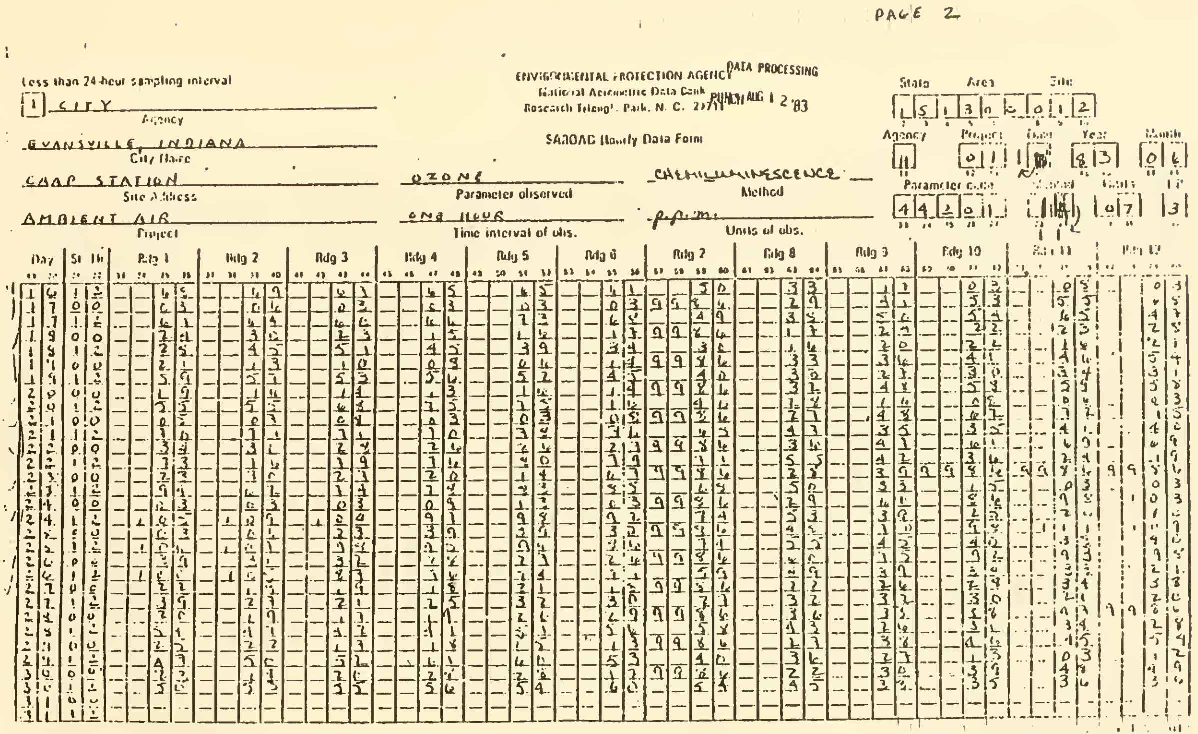
Units of obs.

State 1 5 Area 1 3 0 6 Site 0 1 2

Agency 1 Project 0 1 Time Year 8 3 Month 0 6

Parameter code 4 4 2 0 1 Method 1 1 Units 0 7 DP 3

Ozone, CAAP station (site 012), June, 1983 p.1



PAGE 2

Less than 24-hour sampling interval

1 CITY
Agency

EVANSVILLE, INDIANA
City Name

CAAP STATION
Site Address

AMBIENT AIR
Project

OZONE
Parameter observed

ONE HOUR
Time interval of obs.

CHEMILUMINESCENCE
Method

p.p.m.
Units of obs.

ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

DATA PROCESSING
PUNCH AUG 1 2 '83

SAROAD Hourly Data Form

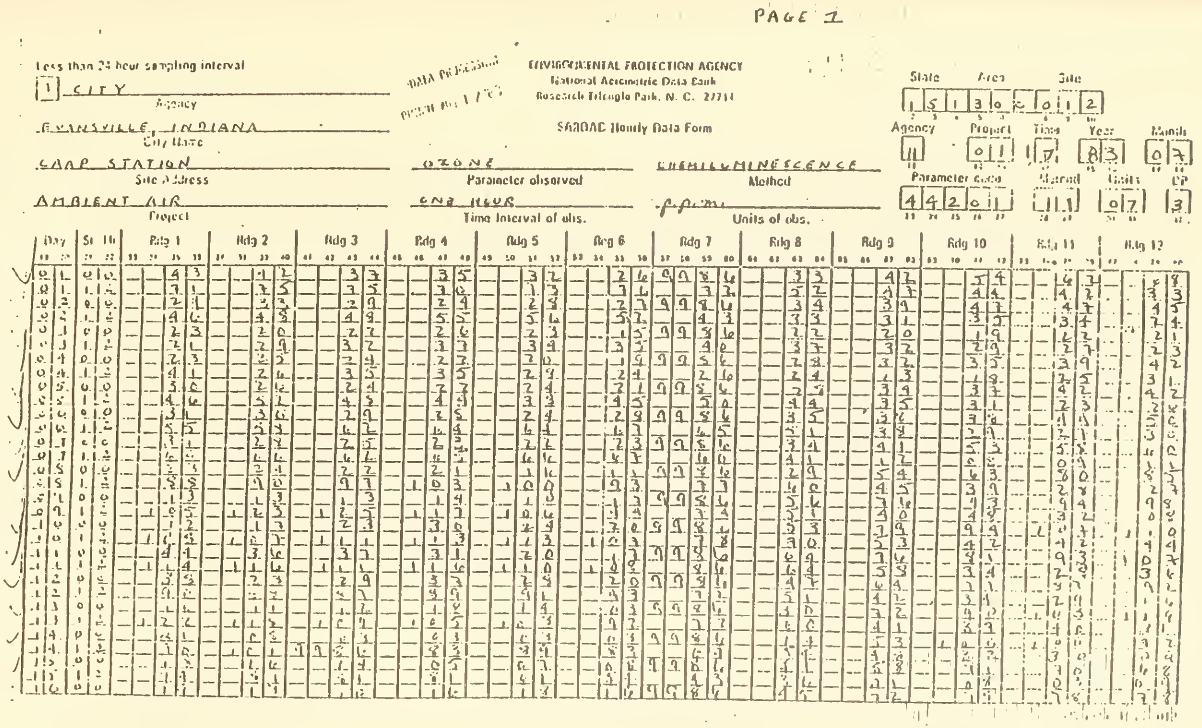
State 1 5 Area 1 3 0 6 Site 0 1 2

Agency 1 Project 0 1 Year 8 3 Month 0 6

Parameter code 4 4 2 0 1 0 7 3

Day | St Hr | Rdg 1 | Rdg 2 | Rdg 3 | Rdg 4 | Rdg 5 | Rdg 6 | Rdg 7 | Rdg 8 | Rdg 9 | Rdg 10

(site 012) June, 1983 p.2



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Less than 24 hour sampling interval

ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

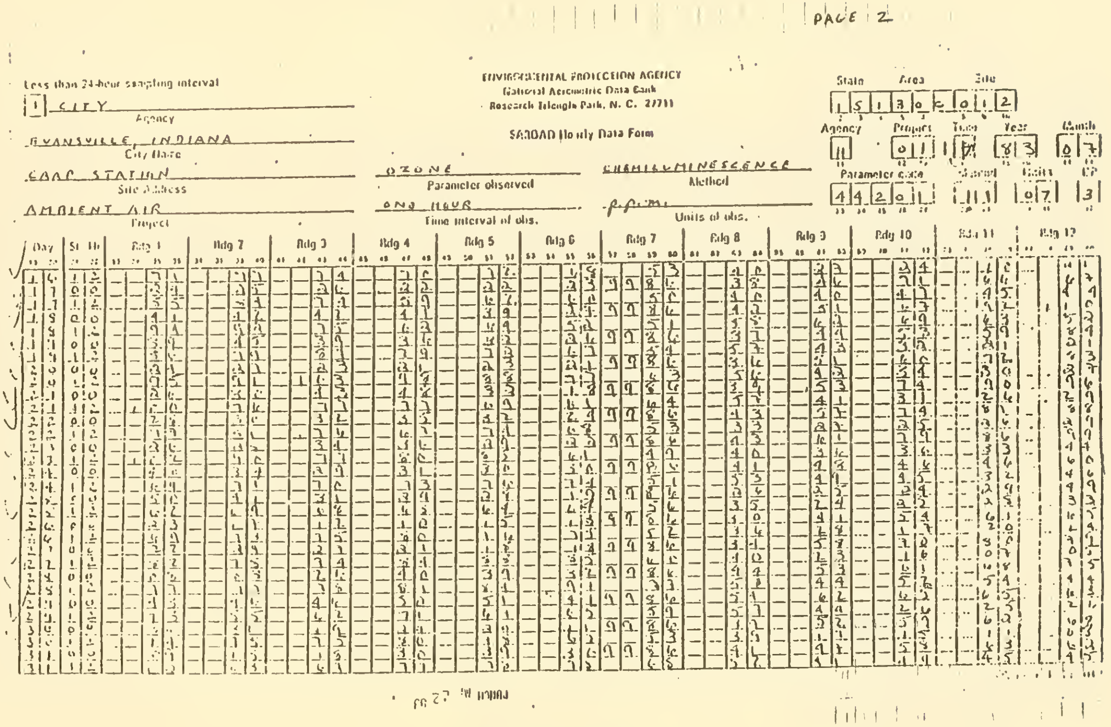
DATA PROCESSED
PUNCH No. 1 / 83

Agency	1 CITY
City Name	EVANSVILLE, INDIANA
Site Address	CAAP STATION
Project	AMBIENT AIR
Parameter observed	OZONE
Time Interval of obs.	ONE HOUR
Method	CHEMILUMINESCENCE
Units of obs.	p.p.m.

State	Area	Site	Agency	Project	Time	Year	Month
15	1 3 0 0	0 1 2	11	0 1	7	8 3	0 7

Parameter code	Method	Units	DP
4 4 2 0 1	1 1	0 7	3

Ozone, CAAP station (site 012), July, 1983 p.1



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ENVIRONMENTAL PROTECTION AGENCY
National Aerometric Data Bank
Research Triangle Park, N. C. 27711

SAROAD Hourly Data Form

Less than 24-hour sampling interval

1 CITY
Agency

EVANSVILLE, INDIANA
City Name

CAAC STATION
Site Address

AMBIENT AIR
Project

OZONE
Parameter observed

ONE HOUR
Time interval of obs.

CHEMILUMINESCENCE
Method

p.p.m.
Units of obs.

State	Area	Site
1 5	1 3 0	E 0 1 2

Agency	Project	Time	Year	Month
1	0 1	1	8 3	0 7

Parameter code	Method	Units	DP
4 4 2 0 1	1 1	0 7	3

Day | St Hr | Rdg 1 | Rdg 2 | Rdg 3 | Rdg 4 | Rdg 5 | Rdg 6 | Rdg 7 | Rdg 8 | Rdg 9 | Rdg 10 | Rdg 11 | Rdg 12

(site 012) July, 1983 p.2

```
                              SAROAD HOURLY DATA
                        1
STATE                  15     INDIANA
CITY                 1300     EVANSVILLE
SITE                  012     FIRE STATION NO. 17
AGENCY                  F     INDIANA AIR POLLUTION CONTROL
PROJECT                01     POP. ORIENTED SURVEILLANCE
TIME                    1     1 HOUR
YEAR                   83
MONTH                  08*
PARAMETER           44201     O3
METHOD                 11     CHEMILUMINESCENCE
UNITS                  07     PPM
DECIMAL                 3

*DAY :ST  :  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG
:    :  HR:    1    2    3    4    5    6    7    8    9   10   11   12
=======================================================================
:  1 :   0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
:  1 :  12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
-----------------------------------------------------------------------
:  2 :   0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
:  2 :  12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
-----------------------------------------------------------------------
:  3 :   0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
:  3 :  12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
-----------------------------------------------------------------------
:  4 :   0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
:  4 :  12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
-----------------------------------------------------------------------
:  5 :   0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
:  5 :  12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
-----------------------------------------------------------------------
:  6 :   0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
:  6 :  12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
-----------------------------------------------------------------------
:  7 :   0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
:  7 :  12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999   35
-----------------------------------------------------------------------
:  8 :   0 :   32   31   25   24 9999 9999   24   32   43   56   58   58
:  8 :  12 :   95   99   97   99  105   74 9999   59   49   36   31   29
-----------------------------------------------------------------------
:  9 :   0 :   25   26   17   14   15 9999    6   20   42   69   72   70
:  9 :  12 :   78   77   75   81   82   74   73   76   58   48   45   42
-----------------------------------------------------------------------
: 10 :   0 :   38   35   33   31   25 9999   20   16   23   27 9999   72
: 10 :  12 :   94   85   95   95   92   83   77   64   65   69   64   58
-----------------------------------------------------------------------
: 11 :   0 :   66   66   63   56   51 9999   42   37   38   49   54   59
: 11 :  12 :   61   62   63   51   52   48   50   48   44   39   34   34
-----------------------------------------------------------------------
: 12 :   0 :   30   26   22   21   18 9999   15   16   22   35   42   46
: 12 :  12 :   48   50   52   55   56   53   52   37   17    7    3    3
-----------------------------------------------------------------------
: 13 :   0 :    5   11   21   24   24 9999   12   19   23   24   22   25
: 13 :  12 :   63   76   79   79   76   78   73   56   44    6    5   42
-----------------------------------------------------------------------
```

Ozone, CAAP station (site 012), August, 1983 p.1

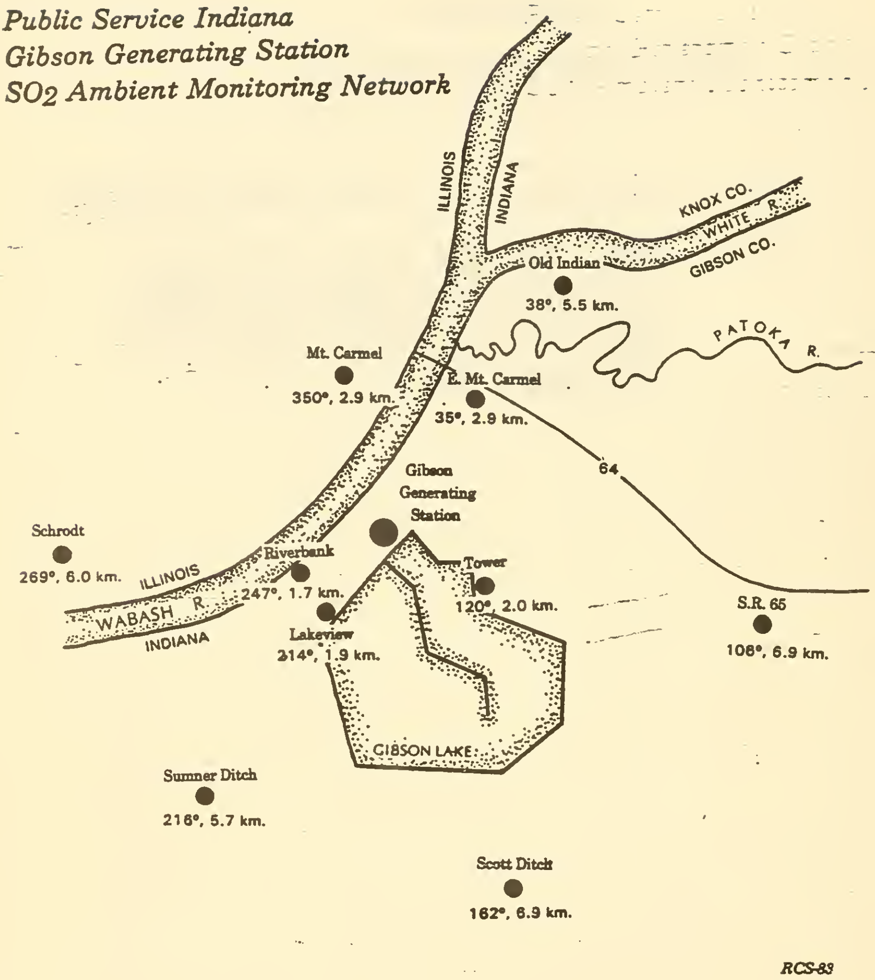
```
08-83   03      012    FIRE STATION NO. 17

*DAY :ST  :  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG  RDG
:    :  HR:    1    2    3    4    5    6    7    8    9   10   11   12
==========================================================================
: 14 :  0 :   34   38   35   30   32 9999   24   28   40   48   58   67
: 14 : 12 :   80   79   84   89   90   87   81   64   51    3    3   41
--------------------------------------------------------------------------
: 15 :  0 :   36   31   33   33   34 9999   23   14   14   38   65   68
: 15 : 12 :   81   95   96   96   91   89   83   69   55    3    3    3
--------------------------------------------------------------------------
: 16 :  0 :    3    3    3    3    3 9999    3    3   14   59   77   82
: 16 : 12 :   80   77   77   76   73   69   64   61   48    3    3   36
--------------------------------------------------------------------------
: 17 :  0 :   38   49   41   36   33    3   18 9999   29   42   49   57
: 17 : 12 :   53   75   65   45   40   45   44   36   22    3    3   46
--------------------------------------------------------------------------
: 18 :  0 :   44   28   27   29   26   25   17 9999   33   30   40   52
: 18 : 12 :   59   64   69   70   63   62   67   72   54    3    3 9999
--------------------------------------------------------------------------
: 19 :  0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
: 19 : 12 : 9999 9999 9999   64   64   66   60   46   32 9999 9999 9999
--------------------------------------------------------------------------
: 20 :  0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
: 20 : 12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
--------------------------------------------------------------------------
: 21 :  0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
: 21 : 12 : 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999    3
--------------------------------------------------------------------------
: 22 :  0 : 9999 9999 9999 9999 9999 9999 9999 9999 9999   48   57   70
: 22 : 12 :   80   94   73   53   59   50   36   51   44   36   24   25
--------------------------------------------------------------------------
: 23 :  0 :   14   13   13    3    3    3    3 9999    7   74   23   33
: 23 : 12 :   41   45   51   63   60   67   64 9999 9999   74    3    3
--------------------------------------------------------------------------
: 24 :  0 :    3    3    3    3    3    3    3 9999   12   23   33   53
: 24 : 12 :   66   51   43   43   60   58   78   64   45   39   23   22
--------------------------------------------------------------------------
: 25 :  0 :   21   15   16   16   11    7    3 9999   24   42   59   71
: 25 : 12 :   90   86   89  100  102   91   85   75   57   46   36   32
--------------------------------------------------------------------------
: 26 :  0 :   29   27   25   29   31   28   19 9999   25   64   93  105
: 26 : 12 :  111  120  138  151  129  104   87   60   35   25   15    9
--------------------------------------------------------------------------
: 27 :  0 :    6    3    3    3    3    3    3 9999   36   54   61   63
: 27 : 12 :   72   81   78   77   75   71   65   46   52   50   56   54
--------------------------------------------------------------------------
: 28 :  0 :   36   46   45   40   38   36 9999   29   36   34   29   45
: 28 : 12 :   53   63   65   68   69   69   76   62   35   27   42   41
--------------------------------------------------------------------------
: 29 :  0 :   35   31   32   26   20   17 9999    9   20   31   43   55
: 29 : 12 :   57   59   67   73   66   62   61   48   30   28   37   32
--------------------------------------------------------------------------
: 30 :  0 :   35   32   28   21   17   10 9999    3    6   39   55   59
: 30 : 12 :   69   72   71   69   61   59   47   28   21   15    6    6
--------------------------------------------------------------------------
: 31 :  0 :    3    3    3    3    3    3 9999   21   37   44   53   67
: 31 : 12 :   63   62   60   78   82   75   65   58   55   50   45   26
--------------------------------------------------------------------------
VDP = 477.0/744.0 64.1%:  VALID DAYS;  30
```

(site 012) August, 1983 p.2

APPENDIX B

SULFUR DIOXIDE AND WIND DATA

B-1	LOCATION OF PSI SULFUR DIOXIDE MONITORS
B-2	HOURLY SULFUR DIOXIDE CONCENTRATION AT TEN LOCATIONS AROUND THE GIBSON PLANT INCLUDING WIND DIRECTION AND VELOCITY AT ONE SITE. (JUNE, JULY AND AUGUST, 1983)



Public Service Indiana
Gibson Generating Station
SO_2 Ambient Monitoring Network

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
01JUN83	100	317	4.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUN83	200	306	5.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUN83	300	319	5.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUN83	400	307	6.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUN83	500	308	4.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUN83	600	333	7.3	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
01JUN83	700	304	4.5	.	.	.	.	0.001	0.001	.	0.001	.	.
01JUN83	800	330	5	0.001	.	0.001	.	.	.	0.001	.	0.001	0.001
01JUN83	900	338	5.4	0.001	0.004	0.003	0.001	0.003	0.006	0.001	.	0.006	0.004
01JUN83	1000	327	4.5	0.001	0.003	0.003	0.001	0.001	.	0.003	.	0.005	0.004
01JUN83	1100	275	4	.	0.001	0.001	0.001	.	.	0.018	0.001	0.005	0.003
01JUN83	1200	325	6.1	0.001	.	0.001	.	0.001	0.027	0.017	0.001	0.001	0.001
01JUN83	1300	325	9.5	0.001	0.001	.	0.001	0.001	0.005	0.033	0.001	.	0.001
01JUN83	1400	349	16.5	0.001	0.01	0.001	0.001	0.001	0.003	.	0.001	0.005	0.001
01JUN83	1500	318	8.4	0.001	0.001	.	0.001	0.001	0.005	.	0.001	.	.
01JUN83	1600	294	8.4	0.001	0.001	0.007	.	0.001	0.033	.	0.001	0.001	.
01JUN83	1700	324	4.1	0.001	0.001	0.001	0.003	0.001	0.098	.	0.001	0.001	0.001
01JUN83	1800	321	4.7	0.001	0.001	0.001	0.016	0.003	0.107	.	0.001	0.001	0.001
01JUN83	1900	47	3.3	0.003	0.001	0.001	0.024	0.01	0.047	0.001	0.001	0.001	0.001
01JUN83	2000	86	2.8	0.001	0.004	0.001	0.013	0.023	0.006	0.001	0.001	0.001	0.001
01JUN83	2100	124	4.6	0.001	0.001	0.001	0.001	0.007	0.003	0.001	0.001	0.001	0.001
01JUN83	2200	136	9.3	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001
01JUN83	2300	144	10.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUN83	2400	144	10.8	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUN83	100	149	12	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUN83	200	147	12	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
02JUN83	300	155	11.5	0.001	0.001	0.001	0.004	0.001	0.005	0.001	0.001	0.003	0.003
02JUN83	400	162	9.4	0.003	0.003	0.004	0.006	0.001	0.009	0.001	0.001	0.005	0.004
02JUN83	500	165	7.8	0.004	0.003	0.005	0.006	0.001	0.011	0.001	0.001	0.007	0.005
02JUN83	600	160	8.1	.	0.004	0.004	0.005	0.001	0.008	.	0.001	0.007	.
02JUN83	700	157	9.1	.	.	.	.	0.004	0.006	.	0.001	.	.
02JUN83	800	.	10.9	0.021	.	0.015	.	.	.	0.017	.	0.012	.
02JUN83	900	163	11.7	0.041	.	0.013	0.015	0.013	0.016	0.017	0.014	0.023	.
02JUN83	1000	167	11.4	0.026	0.009	0.011	0.012	.	0.024	.	0.019	0.032	0.038
02JUN83	1100	176	12.9	0.007	0.005	0.005	0.007	0.005	.	0.008	0.01	0.01	0.012
02JUN83	1200	180	11.6	0.001	0.003	0.001	0.001	0.003	0.006	0.005	0.004	0.005	0.006
02JUN83	1300	103	8.7	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.003	0.003	0.001
02JUN83	1400	101	7	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.006	0.008	0.003
02JUN83	1500	192	8.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.004	0.031
02JUN83	1600	122	6.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUN83	1700	94	9.3	0.001	0.801	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUN83	1800	106	11.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUN83	1900	113	14.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
02JUN83	2000	110	15	0.005	0.004	0.003	0.007	0.007	0.009	0.003	0.007	0.009	0.01
02JUN83	2100	108	16.8	0.005	0.006	0.003	0.006	0.007	0.009	0.003	0.004	0.007	0.007
02JUN83	2200	110	15.8	0.001	0.003	0.001	0.003	0.003	0.005	0.001	0.001	0.003	0.001
02JUN83	2300	116	15.1	0.005	0.007	0.003	0.009	0.009	0.019	0.001	0.004	0.007	0.004
02JUN83	2400	156	10.3	0.026	0.008	0.006	0.011	0.007	0.012	0.007	0.013	0.018	0.019

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
03JUN83	100	148	10.4	0.040	0.009	0.003	0.017	0.01	0.016	0.006	0.007	0.01	0.013
03JUN83	200	133	11.3	0.008	0.001	0.001	0.006	0.001	0.005	0.003	0.005	0.007	0.008
03JUN83	300	119	12.4	0.003	0.001	0.001	0.001	0.001	0.003	0.001	0.006	0.004	0.007
03JUN83	400	139	12.7	0.02	0.001	0.001	0.01	0.001	0.014	0.007	0.006	0.013	0.019
03JUN83	500	140	12.5	0.008	0.001	0.001	0.001	0.001	0.003	.	0.003	0.003	0.003
03JUN83	600	.	10.5	.	0.009	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
03JUN83	700	114	9.9	.	.	.	.	0.001	0.001	0.001	0.001	.	.
03JUN83	800	131	12.2	0.001	.	0.001	.	.	.	0.001	.	0.001	0.001
03JUN83	900	130	14.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUN83	1000	145	13.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUN83	1100	176	13.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUN83	1200	207	19	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.016	0.02
03JUN83	1300	195	11.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.024	0.077
03JUN83	1400	216	13.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.023	0.006
03JUN83	1500	277	10.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUN83	1600	205	14.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.053	0.001	0.001
03JUN83	1700	270	19.7	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001
03JUN83	1800	281	16.2	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.009	0.001	0.001
03JUN83	1900	277	12.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUN83	2000	272	7.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUN83	2100	249	7.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.006
03JUN83	2200	203	8.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUN83	2300	308	11.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.006	0.001
03JUN83	2400	313	10.8	0.001	0.001	0.001	0.001	0.001	0.004	0.009	0.001	0.003	0.001
04JUN83	100	336	9.9	0.001	0.001	0.001	0.001	0.001	0.012	0.003	0.001	0.003	0.001
04JUN83	200	349	10.8	0.001	0.001	0.001	0.001	0.001	0.008	0.001	0.001	0.007	0.001
04JUN83	300	339	8.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.018	0.001
04JUN83	400	329	6.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUN83	500	325	8	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
04JUN83	600	317	8.3	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
04JUN83	700	280	5.1	.	.	.	.	0.001	0.001	0.001	0.001	.	.
04JUN83	800	299	6.9	0.001	.	0.001	.	.	.	0.001	.	0.001	0.001
04JUN83	900	312	6.4	0.001	0.005	0.001	0.001	0.001	0.003	0.001	0.001	0.004	0.001
04JUN83	1000	318	6	0.001	0.003	0.001	0.001	0.001	0.004	0.006	0.001	0.003	0.001
04JUN83	1100	326	7.3	0.003	0.003	0.001	0.001	0.001	0.003	0.001	0.003	0.004	0.001
04JUN83	1200	328	9.7	0.001	0.004	0.001	0.001	0.001	0.003	0.001	0.001	0.005	0.001
04JUN83	1300	333	12	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001
04JUN83	1400	322	10.5	0.001	0.001	0.001	0.001	0.001	0.001	0.018	0.001	0.005	0.001
04JUN83	1500	322	12.5	0.001	0.001	0.001	0.001	0.001	0.001	0.015	0.001	0.006	0.001
04JUN83	1600	318	12.6	0.001	0.001	0.001	0.001	0.001	0.001	0.03	0.001	0.005	0.001
04JUN83	1700	340	12.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUN83	1800	342	10.3	0.001	0.001	0.001	0.001	0.001	0.014	0.001	0.001	0.001	0.001
04JUN83	1900	337	7.6	0.001	0.001	0.001	0.001	0.001	0.033	0.001	0.001	0.001	0.001
04JUN83	2000	334	7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUN83	2100	343	7.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUN83	2200	356	5.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUN83	2300	9	6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUN83	2400	334	4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
05JUN83	100	204	4.1	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
05JUN83	200	191	5.1	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
05JUN83	300	202	5	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
05JUN83	400	208	5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUN83	500	203	4.4	0.001	0.001	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001
05JUN83	600	191	5.6	.	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	.
05JUN83	700	203	6.2	.	.	.	.	0.001	0.003	0.001	0.001	.	.
05JUN83	800	210	7.3	0.001	.	0.001	.	.	.	0.004	.	0.001	0.001
05JUN83	900	205	7.7	0.001	0.001	0.001	0.001	0.001	0.01	0.003	0.001	0.005	0.008
05JUN83	1000	205	5.9	0.001	0.003	0.001	0.003	0.003	0.017	0.006	0.006	0.007	0.012
05JUN83	1100	216	7.8	0.003	0.005	0.005	0.007	0.006	0.013	0.009	0.009	0.059	0.007
05JUN83	1200	209	5.8	0.004	0.006	0.004	0.005	0.004	0.009	0.006	0.004	0.008	0.213
05JUN83	1300	205	4.9	0.004	0.005	0.004	0.005	0.004	0.01	0.006	0.005	0.013	0.014
05JUN83	1400	187	3.2	0.003	0.005	0.001	0.003	0.001	0.007	0.005	0.004	0.066	0.102
05JUN83	1500	192	3.2	0.001	0.005	0.001	0.001	0.001	0.006	0.003	0.003	0.034	0.332
05JUN83	1600	170	3.5	0.004	0.01	0.003	0.004	0.003	0.005	0.001	0.001	0.046	0.034
05JUN83	1700	186	3.5	0.009	0.014	0.01	0.01	0.011	0.008	0.003	0.001	0.019	0.053
05JUN83	1800	196	5.2	0.013	0.01	0.012	0.013	0.011	0.012	0.009	0.005	0.033	0.05
05JUN83	1900	207	4.6	0.01	0.009	0.011	0.013	0.011	0.011	0.012	0.004	0.013	0.029
05JUN83	2000	162	9	0.008	0.006	0.005	0.005	0.004	0.004	0.003	0.001	0.005	0.007
05JUN83	2100	166	10.3	0.003	0.005	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
05JUN83	2200	171	10.5	0.001	0.003	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
05JUN83	2300	177	10.4	0.001	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001
05JUN83	2400	324	9.7	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001
06JUN83	100	315	11.5	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.001	0.005	0.001
06JUN83	200	352	14.3	0.001	0.001	0.001	0.001	0.001	0.044	0.001	0.001	0.001	0.001
06JUN83	300	25	8.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
06JUN83	400	9	6.4	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.003
06JUN83	500	335	6.9	0.001	0.001	0.001	0.001	0.001	0.003	.	0.001	0.003	0.003
06JUN83	600	326	13.3	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
06JUN83	700	336	13.1	.	.	.	.	0.001	0.044	0.001	0.001	.	.
06JUN83	800	332	12.4	0.001	.	0.001	.	.	.	0.001	.	0.015	0.001
06JUN83	900	332	11.5	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.018	0.001
06JUN83	1000	337	11.3	0.001	0.001	0.001	0.001	0.001	0.007	0.001	0.001	0.017	0.001
06JUN83	1100	335	11.3	0.001	0.001	0.001	0.001	0.001	0.047	0.001	0.001	0.015	0.001
06JUN83	1200	339	12	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.013	0.001
06JUN83	1300	331	12.7	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.008	0.001
06JUN83	1400	330	14	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.005	0.001
06JUN83	1500	337	13.5	0.001	0.001	0.001	0.001	0.001	0.009	0.001	0.001	0.003	0.001
06JUN83	1600	346	10.7	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
06JUN83	1700	340	11.2	0.001	0.001	0.001	0.001	0.001	0.027	0.001	0.001	0.004	0.001
06JUN83	1800	326	13.6	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.004	0.001
06JUN83	1900	335	14.8	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.012	0.001
06JUN83	2000	348	12.5	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.003	0.001
06JUN83	2100	342	8.1	0.001	0.001	0.001	0.001	0.001	0.007	0.001	0.001	0.026	0.001
06JUN83	2200	332	10	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
06JUN83	2300	328	11.1	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
06JUN83	2400	325	9.9	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.005	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
07JUN83	100	325	9.1	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.009	0.001	0.001
07JUN83	200	325	8.7	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.006	0.001	0.001
07JUN83	300	322	7.8	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
07JUN83	400	307	6.4	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
07JUN83	500	305	5.4	0.001	0.001	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001
07JUN83	600	265	5.7	.	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	.
07JUN83	700	305	6.1	.	.	.	.	0.001	0.003	0.001	0.001	.	.
07JUN83	800	337	8.7	0.001	.	0.001	.	.	.	0.001	.	0.006	0.001
07JUN83	900	341	8.3	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.03	0.001
07JUN83	1000	334	7.4	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.008	0.008	0.001
07JUN83	1100	294	7.3	0.001	0.001	0.001	0.001	0.001	0.008	0.02	0.017	0.001	0.003
07JUN83	1200	288	6.7	0.001	0.001	0.001	0.001	0.001	0.004	0.031	0.086	0.001	0.001
07JUN83	1300	306	8	0.005	0.009	0.005	0.004	0.003	0.005	0.098	0.09	0.005	0.001
07JUN83	1400	309	8.3	0.007	0.003	0.005	0.006	0.006	0.01	0.064	0.024	0.009	0.012
07JUN83	1500	313	9.1	0.001	0.001	0.001	0.001	0.001	0.005	0.113	0.009	0.003	0.005
07JUN83	1600	313	8.9	0.001	0.001	0.001	0.001	0.001	0.004	0.025	0.004	0.005	0.004
07JUN83	1700	321	9.4	0.004	0.005	0.003	0.004	0.003	0.006	0.009	0.004	0.005	0.006
07JUN83	1800	331	8.6	0.001	0.004	0.001	0.004	0.004	0.007	0.004	0.001	0.001	0.001
07JUN83	1900	330	9.3	0.001	0.004	0.001	0.001	0.004	0.009	0.001	0.001	0.001	0.001
07JUN83	2000	326	8	0.001	0.004	0.001	0.001	0.005	0.005	0.001	0.001	0.001	0.001
07JUN83	2100	308	7	0.001	0.003	0.001	0.001	0.003	0.004	0.001	0.001	0.001	0.001
07JUN83	2200	295	7.9	0.001	0.003	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
07JUN83	2300	289	7.2	0.001	0.004	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
07JUN83	2400	281	7.2	0.001	0.003	0.001	0.001	0.001	0.005	0.003	0.001	0.001	0.001
08JUN83	100	275	8.8	0.001	0.003	0.001	0.003	0.001	0.005	0.001	0.001	0.003	0.001
08JUN83	200	272	5.2	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
08JUN83	300	272	5.9	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
08JUN83	400	254	6.1	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
08JUN83	500	255	7	0.001	0.002	0.001	0.001	0.001	0.003	.	0.001	0.001	0.004
08JUN83	600	255	5.7	.	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	.
08JUN83	700	257	6.7	.	.	.	.	0.001	0.004	0.001	0.001	.	.
08JUN83	800	274	7.9	0.001	.	0.003	.	.	.	0.001	.	0.003	0.003
08JUN83	900	287	7.2	0.001	0.004	0.001	.	0.003	0.004	0.001	0.001	0.001	0.001
08JUN83	1000	312	8	0.001	0.005	0.001	.	0.005	0.006	0.001	0.003	0.001	0.001
08JUN83	1100	307	5.9	0.001	0.003	0.001	.	0.003	0.006	0.028	0.006	0.001	0.001
08JUN83	1200	279	6	0.001	0.003	0.001	.	0.001	0.009	0.004	0.007	0.001	0.001
08JUN83	1300	290	5.7	0.001	0.003	0.001	.	0.001	0.006	0.015	0.011	0.001	0.001
08JUN83	1400	321	5.2	0.001	0.003	0.001	.	0.001	0.005	0.003	0.028	0.001	0.001
08JUN83	1500	202	11.8	0.001	0.001	0.001	.	0.001	0.005	0.001	0.004	0.001	0.001
08JUN83	1600	297	7.7	0.001	0.001	0.001	.	0.001	0.005	0.001	0.014	0.001	0.001
08JUN83	1700	291	6.9	0.001	0.001	0.001	.	0.001	0.005	0.006	0.001	0.001	0.001
08JUN83	1800	309	5.9	0.001	0.001	0.001	.	0.001	0.026	0.024	0.017	0.001	0.001
08JUN83	1900	310	6.8	0.001	0.001	0.001	.	0.003	0.016	0.001	0.006	0.001	0.001
08JUN83	2000	298	6.2	0.001	0.001	0.001	.	0.001	0.006	0.001	0.001	0.001	0.001
08JUN83	2100	295	5.8	0.001	0.001	0.001	0.003	0.001	0.005	0.001	0.001	0.001	0.001
08JUN83	2200	305	6.6	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
08JUN83	2300	304	6.6	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
08JUN83	2400	292	4.4	0.001	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
09JUN83	100	295	4.9	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
09JUN83	200	293	4.6	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
09JUN83	300	283	2.4	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
09JUN83	400	260	3.2	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
09JUN83	500	269	2.8	0.001	0.001	0.001	0.001	0.001	0.004	.	0.001	0.001	0.001
09JUN83	600	66	4	.	0.001	0.001	0.001	0.001	0.004	0.001	0.001	.	.
09JUN83	700	107	5.9	.	.	.	0.001	0.001	0.004	0.001	0.001	.	.
09JUN83	800	120	3.8	0.001	.	0.001	0.001	.	.	0.001	.	0.001	0.001
09JUN83	900	183	1.9	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001
09JUN83	1000	172	1.8	0.001	0.003	0.001	0.001	0.003	0.007	0.001	0.003	0.004	0.023
09JUN83	1100	190	2.5	0.004	0.003	0.001	0.003	0.003	0.007	0.004	0.001	0.021	0.003
09JUN83	1200	180	3.7	0.004	0.003	0.001	0.001	0.003	0.007	0.001	0.001	0.029	0.018
09JUN83	1300	197	4.3	0.003	0.004	0.001	0.001	0.003	0.009	0.001	0.003	0.083	0.086
09JUN83	1400	252	3.8	0.001	0.003	0.001	0.003	0.003	0.008	0.001	0.003	0.126	0.217
09JUN83	1500	221	4.9	0.001	0.004	0.001	0.003	0.003	0.005	0.001	0.001	0.103	0.204
09JUN83	1600	248	6.7	0.001	0.003	0.001	0.001	0.003	0.007	0.001	0.001	0.105	0.157
09JUN83	1700	254	5.7	0.001	0.001	0.001	0.001	0.003	0.007	0.001	0.001	0.015	0.049
09JUN83	1800	257	4.9	0.001	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.003	0.018
09JUN83	1900	271	7	0.001	0.001	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.001
09JUN83	2000	265	5	0.001	0.001	0.001	.	0.001	0.004	0.001	0.001	0.001	0.001
09JUN83	2100	174	4	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
09JUN83	2200	107	3	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001
09JUN83	2300	204	4.3	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001
09JUN83	2400	205	4	0.001	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.003	0.001
10JUN83	100	211	5.3	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001
10JUN83	200	197	5.8	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001
10JUN83	300	197	4.8	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.003	0.001
10JUN83	400	161	5.1	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
10JUN83	500	177	4.6	0.001	0.001	0.001	0.001	0.001	0.004	.	0.001	0.001	0.001
10JUN83	600	206	4.3	.	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	.
10JUN83	700	162	3.9	.	.	.	0.001	0.001	0.004	0.001	0.001	.	.
10JUN83	800	156	5.7	0.001	.	0.001	0.001	.	.	0.006	.	0.013	0.004
10JUN83	900	128	2.7	0.003	0.007	0.006	0.007	0.006	0.009	0.006	0.000	0.011	0.01
10JUN83	1000	135	2.9	0.005	0.007	0.008	0.007	0.006	0.009	0.007	0.011	0.009	0.008
10JUN83	1100	170	3.7	0.008	0.012	0.008	0.007	0.009	0.013	0.007	0.006	0.009	0.020
10JUN83	1200	195	3.1	0.004	0.006	0.007	0.005	0.005	0.007	0.006	0.004	0.033	0.139
10JUN83	1300	202	7.2	0.008	0.004	0.004	0.003	0.003	0.007	0.001	0.003	0.072	0.031
10JUN83	1400	199	6.1	0.044	0.004	0.005	0.006	0.004	0.009	0.004	0.005	0.009	0.004
10JUN83	1500	199	6.1	0.027	0.003	0.003	0.001	0.001	0.005	0.001	0.001	0.004	0.005
10JUN83	1600	146	8.1	0.005	0.003	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
10JUN83	1700	157	6.3	0.001	0.006	0.003	0.004	0.005	0.008	0.001	0.003	0.001	0.001
10JUN83	1800	168	8.2	0.007	0.006	0.006	0.005	0.004	0.008	0.004	0.003	0.005	0.005
10JUN83	1900	162	8.1	0.004	0.003	0.004	0.004	0.001	0.005	0.003	0.003	0.004	0.004
10JUN83	2000	152	7.9	0.001	0.003	0.003	.	0.001	0.005	0.001	0.001	0.001	0.001
10JUN83	2100	124	9	0.003	0.003	0.003	0.003	0.001	0.005	0.001	0.009	0.004	0.004
10JUN83	2200	120	11.7	0.005	0.005	0.005	0.007	0.001	0.009	0.003	0.004	0.005	0.007
10JUN83	2300	129	12.9	0.004	0.006	0.004	0.004	0.001	0.005	0.003	0.003	0.003	0.003
10JUN83	2400	142	12.7	0.003	0.003	0.001	0.001	0.001	0.004	0.003	0.001	0.001	0.003

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
11JUN83	100	149	10.4	0.001	0.001	0.001	0.003	0.001	0.003	0.001	0.001	0.001	0.001
11JUN83	200	147	10.1	0.001	0.003	0.001	0.004	0.001	0.005	0.001	0.001	0.001	0.001
11JUN83	300	146	10.6	0.001	0.003	0.001	0.004	0.001	0.006	0.001	0.001	0.001	0.001
11JUN83	400	146	9.3	0.001	0.005	0.001	0.005	0.001	0.01	0.001	0.001	0.001	0.001
11JUN83	500	144	8.6	0.001	0.005	0.001	0.005	0.001	0.008	.	0.001	0.001	0.001
11JUN83	600	158	6.8	.	0.008	0.001	0.008	0.001	0.008	0.001	0.001	0.001	.
11JUN83	700	143	8.4	.	.	.	0.005	0.001	0.006	0.001	0.001	.	.
11JUN83	800	142	7.8	0.003	.	0.003	0.004	.	.	0.001	.	0.001	0.001
11JUN83	900	145	5.3	0.005	0.004	0.004	0.003	0.001	0.005	0.001	0.001	0.001	0.003
11JUN83	1000	152	5.4	0.063	0.003	0.003	0.001	0.001	0.005	0.001	0.001	0.001	0.003
11JUN83	1100	173	9.7	0.005	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11JUN83	1200	176	11.9	0.053	0.009	0.001	0.001	0.004	0.004	0.001	0.001	0.001	0.001
11JUN83	1300	178	13.4	0.009	0.007	0.005	0.003	0.003	0.007	0.003	0.001	0.001	0.003
11JUN83	1400	189	11.6	0.015	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
11JUN83	1500	177	10.6	0.029	0.004	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
11JUN83	1600	167	11.8	0.087	0.004	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
11JUN83	1700	155	11.6	0.004	0.004	0.003	0.001	0.003	0.005	0.001	0.001	0.001	0.003
11JUN83	1800	161	11.8	0.005	0.004	0.001	0.001	0.001	0.005	0.001	0.003	0.001	0.003
11JUN83	1900	164	11.9	0.008	0.003	0.003	0.001	0.001	0.005	0.001	0.001	0.001	0.003
11JUN83	2000	153	8.9	0.001	0.004	0.001	.	0.001	0.004	0.001	0.001	0.001	0.001
11JUN83	2100	146	10.1	0.001	0.004	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
11JUN83	2200	155	10	0.001	0.004	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
11JUN83	2300	164	9	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
11JUN83	2400	159	10	0.001	0.001	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001
12JUN83	100	162	10.3	0.001	0.003	0.001	0.003	0.001	0.008	0.001	0.001	0.001	0.001
12JUN83	200	166	8.7	0.001	0.003	0.001	0.001	0.001	0.007	0.001	0.001	0.003	0.001
12JUN83	300	163	7.7	0.001	0.003	0.001	0.001	0.003	0.007	0.001	0.001	0.001	0.001
12JUN83	400	155	7.9	0.001	0.003	0.001	0.001	0.001	0.008	0.001	0.001	0.001	0.001
12JUN83	500	147	10.2	0.001	0.004	0.001	0.004	0.001	0.011	.	0.001	0.003	0.001
12JUN83	600	139	10.1	.	0.005	0.001	0.003	0.001	0.007	0.001	0.001	0.003	.
12JUN83	700	141	9.6	.	.	.	0.001	0.001	0.006	0.001	0.001	.	.
12JUN83	800	148	7.1	0.003	.	0.001	0.001	.	.	0.001	.	0.004	0.001
12JUN83	900	148	5.2	0.009	0.004	0.001	0.003	0.004	0.008	0.001	0.001	0.003	0.001
12JUN83	1000	159	7.2	0.018	0.004	0.004	0.004	0.004	0.008	0.005	0.008	0.006	0.005
12JUN83	1100	172	9.8	0.012	0.008	0.005	0.005	0.008	0.011	0.006	0.005	0.006	0.005
12JUN83	1200	169	11.7	0.035	0.007	0.004	0.004	0.006	0.009	0.004	0.004	0.004	0.004
12JUN83	1300	159	15.3	0.068	0.006	0.004	0.003	0.006	0.008	0.004	0.003	0.004	0.004
12JUN83	1400	160	14.4	0.092	0.004	0.001	0.001	0.003	0.008	0.003	0.005	0.003	0.004
12JUN83	1500	164	16.3	0.08	0.004	0.005	0.004	0.004	0.009	0.005	0.001	0.005	0.005
12JUN83	1600	163	14.9	0.034	0.004	0.005	0.005	0.005	0.009	0.004	0.001	0.004	0.003
12JUN83	1700	174	14	0.08	0.006	0.006	0.004	0.005	0.008	0.004	0.001	0.004	0.001
12JUN83	1800	171	13.3	0.033	0.005	0.004	0.003	0.005	0.008	0.004	0.001	0.001	0.001
12JUN83	1900	164	11.6	0.014	0.005	0.004	0.004	0.005	0.006	0.001	0.001	0.003	0.001
12JUN83	2000	155	9.7	0.003	0.005	0.001	.	0.004	0.004	0.001	0.001	0.001	0.001
12JUN83	2100	145	11.3	0.001	0.004	0.001	0.001	0.003	0.004	0.001	0.001	0.001	0.001
12JUN83	2200	139	10.3	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
12JUN83	2300	147	13.1	0.003	0.003	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.003
12JUN83	2400	157	12.5	0.003	0.003	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.003

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
13JUN83	100	167	9.4	0.005	0.003	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
13JUN83	200	168	9.5	0.004	0.005	0.003	0.005	0.001	0.01	0.001	0.001	0.001	0.001
13JUN83	300	157	9.3	0.004	0.007	0.006	0.006	0.001	0.013	0.001	0.001	0.003	0.001
13JUN83	400	152	0.1	0.004	0.005	0.003	0.007	0.001	0.016	0.001	0.001	0.001	0.001
13JUN83	500	152	10.2	0.004	0.006	0.004	0.009	0.006	0.012	.	0.001	0.001	0.001
13JUN83	600	144	10	.	0.007	0.003	0.006	0.006	0.01	0.001	0.001	0.001	.
13JUN83	700	128	14	.	.	.	0.005	0.003	0.007	0.001	0.001	.	.
13JUN83	800	130	8	0.007	.	0.008	0.008	.	.	0.003	.	0.005	0.005
13JUN83	900	154	7.1	0.024	0.008	0.009	0.009	0.008	0.005	0.007	0.001	0.007	0.011
13JUN83	1000	175	9.1	0.009	0.005	0.006	0.005	0.005	0.006	0.004	0.003	0.003	0.006
13JUN83	1100	178	12.5	0.006	0.006	0.006	0.005	0.006	0.006	0.004	0.001	0.003	0.006
13JUN83	1200	177	13.8	0.037	0.004	0.003	0.003	0.003	0.004	0.001	0.001	0.001	0.003
13JUN83	1300	161	11.8	0.037	0.001	0.003	0.004	0.003	0.005	0.001	0.001	0.001	0.001
13JUN83	1400	172	11.3	0.008	0.004	0.003	0.004	0.005	0.005	0.001	0.001	0.001	0.001
13JUN83	1500	168	10.2	0.013	0.004	0.004	0.004	0.004	0.006	0.003	0.005	0.001	0.007
13JUN83	1600	159	9.5	0.016	0.003	0.007	0.007	0.005	0.009	0.006	0.003	0.004	0.007
13JUN83	1700	157	10.2	0.013	0.005	0.005	0.005	0.005	0.004	0.001	0.001	0.001	0.004
13JUN83	1800	155	12.1	0.005	0.003	0.004	0.005	0.003	0.006	0.004	0.006	0.001	0.007
13JUN83	1900	158	11.5	0.007	0.003	0.005	0.005	0.004	0.005	0.005	0.004	0.004	0.009
13JUN83	2000	141	10.8	0.004	0.003	0.001	.	0.003	0.003	0.003	0.004	0.001	0.007
13JUN83	2100	125	12.5	0.006	0.003	0.007	0.007	0.003	0.006	0.005	0.001	0.003	0.004
13JUN83	2200	130	13	0.003	0.005	0.007	0.007	0.003	0.006	0.003	0.001	0.001	0.001
13JUN83	2300	143	13.8	0.007	0.005	0.008	0.009	0.005	0.009	0.004	0.001	0.001	0.001
13JUN83	2400	152	14.5	0.006	0.006	0.005	0.005	0.005	0.007	0.004	0.004	0.003	0.005
14JUN83	100	156	15.1	0.004	0.005	0.004	0.005	0.005	0.006	0.003	0.003	0.001	0.004
14JUN83	200	166	15.1	0.019	0.006	0.006	0.01	0.004	0.008	0.007	0.001	0.001	0.001
14JUN83	300	172	12.3	0.011	0.013	0.008	0.009	0.006	0.013	0.009	0.001	0.007	0.006
14JUN83	400	154	11.6	0.008	0.01	0.008	0.007	0.006	0.012	0.008	0.001	0.007	0.006
14JUN83	500	155	10	0.011	0.007	0.009	0.013	0.006	0.017	.	0.001	0.008	0.009
14JUN83	600	170	8.9	.	0.009	0.012	0.011	0.007	0.011	0.003	0.005	0.004	.
14JUN83	700	157	0.3	.	.	.	0.006	0.005	0.01	0.005	0.005	.	.
14JUN83	800	157	8	0.024	.	0.005	0.005	.	.	0.005	.	0.005	0.004
14JUN83	900	169	9.8	0.034	0.006	0.005	0.005	0.006	0.006	0.005	0.001	0.003	0.003
14JUN83	1000	170	14.6	0.025	0.009	0.009	0.001	0.001	0.001	0.01	.	0.008	0.009
14JUN83	1100	172	14.4	0.013	0.005	0.001	.	0.001	0.007	0.006	.	0.001	0.007
14JUN83	1200	.	11.8	0.001	0.001	0.004	0.004	0.005	0.005	0.001	.	0.001	0.003
14JUN83	1300	161	15.3	0.034	0.006	0.005	0.004	.	.	0.004	0.006	0.003	0.001
14JUN83	1400	178	15.5	0.007	0.005	0.003	0.003	0.013	.	0.004	0.004	0.001	0.004
14JUN83	1500	179	16	0.006	0.003	0.003	0.001	0.003	.	.	0.003	0.001	0.001
14JUN83	1600	173	18.2	0.017	0.001	0.001	0.001	.	0.003	0.001	0.001	0.001	0.001
14JUN83	1700	174	17.8	0.001	0.001	0.001	0.001	.	0.001	0.001	.	0.001	0.001
14JUN83	1800	195	19.1	0.008	0.001	0.001	0.001	.	.	0.001	0.001	0.001	0.001
14JUN83	1900	191	16.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
14JUN83	2000	243	22.1	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001	0.001
14JUN83	2100	260	14.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
14JUN83	2200	207	6.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
14JUN83	2300	189	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
14JUN83	2400	170	12.3	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMMER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
15JUN83	100	169	12.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUN83	200	181	10.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001
15JUN83	300	183	9.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.008	0.001
15JUN83	400	212	10.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.127	0.007
15JUN83	500	234	9.3	0.001	0.001	0.001	0.001	0.001	0.001	.	0.031	0.006	0.01
15JUN83	600	266	9.8	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	.
15JUN83	700	324	9.1	.	.	.	0.001	0.001	0.001	0.001	0.003	.	.
15JUN83	800	327	6.7	0.001	.	0.001	0.001	.	.	0.004	.	0.014	0.001
15JUN83	900	320	5.7	0.003	0.001	0.001	0.004	0.003	0.006	0.005	0.001	0.004	0.003
15JUN83	1000	322	4.6	0.001	0.001	0.001	.	0.001	0.029	0.004	0.001	0.003	0.001
15JUN83	1100	304	4.8	0.001	0.001	0.001	.	0.001	0.193	0.001	0.001	0.001	0.001
15JUN83	1200	331	6.2	0.001	0.001	.	0.001	0.001	0.064	.	0.001	0.003	0.001
15JUN83	1300	328	6	0.001	0.001	0.001	0.001	0.001	0.094	.	0.001	0.006	0.001
15JUN83	1400	328	11.2	0.001	0.001	0.001	0.001	0.001	0.01	0.031	0.001	.	0.001
15JUN83	1500	307	5.8	0.001	0.001	0.001	0.001	0.001	0.041	0.036	0.001	.	.
15JUN83	1600	330	7.6	0.001	0.001	0.001	0.001	0.001	0.147	0.005	0.001	.	.
15JUN83	1700	341	8.5	0.001	.	0.001	0.001	0.001	0.047	0.001	0.001	0.031	0.001
15JUN83	1800	335	9.5	.	0.001	0.001	.	0.001	0.043	0.001	0.001	0.003	0.001
15JUN83	1900	330	11.4	0.001	0.001	0.001	.	0.001	0.026	0.001	0.001	0.011	0.001
15JUN83	2000	339	11.1	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.014	0.001
15JUN83	2100	347	9.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUN83	2200	353	9.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUN83	2300	358	9.7	0.001	0.001	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.001
15JUN83	2400	2	9.8	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
16JUN83	100	26	7.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUN83	200	34	8.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUN83	300	47	7.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUN83	400	29	7.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUN83	500	36	7.1	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
16JUN83	600	39	8.6	.	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
16JUN83	700	37	7.7	.	.	.	0.004	0.001	0.001	0.001	0.001	.	.
16JUN83	800	25	6.5	0.001	.	.	0.006	.	.	0.001	.	0.001	0.001
16JUN83	900	83	2.4	0.003	0.003	.	0.009	0.003	0.001	0.001	0.001	0.001	0.001
16JUN83	1000	264	2.8	0.007	0.004	.	0.008	0.019	0.004	0.001	0.001	0.001	0.001
16JUN83	1100	270	4.9	0.014	0.012	0.009	0.032	0.067	0.014	0.007	0.003	0.007	.
16JUN83	1200	316	6.1	0.006	0.009	0.009	0.079	0.047	0.012	0.006	0.001	0.006	.
16JUN83	1300	.	8.4	0.004	0.006	0.005	0.107	0.076	0.005	0.004	0.001	0.004	.
16JUN83	1400	327	6.4	0.003	0.005	0.004	0.043	0.108	0.009	0.004	0.001	0.003	0.004
16JUN83	1500	.	8.5	0.001	.	0.003	0.1	0.042	0.008	0.001	0.001	0.001	0.003
16JUN83	1600	273	6.9	0.001	.	0.006	0.032	0.039	0.006	0.001	0.001	0.001	0.001
16JUN83	1700	360	6.9	0.001	0.005	0.003	0.018	0.007	0.006	0.001	0.001	0.001	0.003
16JUN83	1800	329	8.6	.	0.004	0.005	0.005	0.004	0.006	0.003	0.001	0.001	0.003
16JUN83	1900	.	8	.	0.003	0.006	0.012	0.004	0.007	0.003	0.001	0.001	0.001
16JUN83	2000	92	8.8	0.01	0.006	0.011	.	0.01	0.01	0.008	0.001	0.007	0.816
16JUN83	2100	98	8.7	0.007	0.009	0.003	0.001	0.001	0.006	0.001	0.001	0.005	0.009
16JUN83	2200	95	7.5	0.008	0.005	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.005
16JUN83	2300	95	6.3	0.007	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.004
16JUN83	2400	106	7.1	0.007	0.008	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
17JUN83	100	102	4.1	0.003	0.005	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
17JUN83	200	95	3.8	0.001	0.003	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
17JUN83	300	51	5.7	0.001	0.003	0.001	0.083	0.001	0.004	0.001	0.001	0.001	0.001
17JUN83	400	20	5.9	0.001	0.001	0.001	0.004	0.001	0.004	0.001	0.001	0.001	0.001
17JUN83	500	28	4.7	0.001	0.003	0.001	0.001	0.001	0.004	.	0.001	0.001	0.001
17JUN83	600	42	8.3	.	0.001	0.001	0.003	0.001	0.004	0.001	0.001	0.001	.
17JUN83	700	83	5.8	.	.	.	0.001	0.001	0.005	0.001	0.001	.	.
17JUN83	800	65	4.1	0.01	.	0.001	0.005	.	.	0.001	.	0.001	0.001
17JUN83	900	46	4.8	0.003	0.007	0.003	0.005	0.004	0.009	0.004	0.003	0.001	0.003
17JUN83	1000	42	6.3	0.008	0.006	0.01	0.007	0.03	0.07	0.004	0.019	0.007	0.01
17JUN83	1100	25	5.8	0.012	0.011	0.01	0.01	0.028	0.053	0.009	0.043	0.008	0.01
17JUN83	1200	.	4.6	0.008	0.008	0.008	0.017	0.034	0.055	0.019	0.037	0.005	0.008
17JUN83	1300	.	5.1	0.012	0.033	0.025	0.041	0.04	0.022	0.025	0.015	0.013	0.025
17JUN83	1400	.	6.4	0.01	0.125	0.102	0.036	0.02	0.013	0.008	0.001	0.005	0.009
17JUN83	1500	115	6.4	0.006	0.04	0.008	0.007	0.007	0.01	0.005	0.001	0.003	0.006
17JUN83	1600	158	11.2	0.004	0.013	0.003	0.001	0.001	0.004	0.001	0.001	0.001	0.004
17JUN83	1700	178	7.4	0.006	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001
17JUN83	1800	206	4.2	0.004	0.008	0.001	0.001	0.003	0.004	0.001	0.001	0.001	0.001
17JUN83	1900	.	8.1	0.008	0.026	0.008	0.008	0.006	0.004	0.014	0.007	0.004	0.009
17JUN83	2000	28	15	0.004	0.004	0.011	.	0.022	0.006	0.005	0.001	0.001	0.004
17JUN83	2100	25	17.4	0.001	0.001	0.006	0.006	0.015	0.006	0.003	0.001	0.001	0.001
17JUN83	2200	21	11.6	0.001	0.001	0.001	0.006	0.001	0.003	0.001	0.001	0.001	0.001
17JUN83	2300	44	9.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUN83	2400	117	10	0.001	0.001	0.001	0.003	0.001	0.003	0.001	0.001	0.001	0.001
18JUN83	100	102	6.4	0.005	0.001	0.001	0.004	0.001	0.004	0.001	0.001	0.001	0.003
18JUN83	200	107	6.9	0.005	0.003	0.001	0.003	0.001	0.003	0.001	0.001	0.001	0.001
18JUN83	300	134	6.6	0.003	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.004
18JUN83	400	96	6.5	0.005	0.001	0.001	0.01	0.001	0.001	0.001	0.001	0.003	0.005
18JUN83	500	98	8.6	0.007	0.001	0.001	0.008	0.003	0.004	.	0.001	0.003	0.001
18JUN83	600	87	8.6	.	0.001	0.001	0.004	0.001	0.004	0.001	0.001	0.001	.
18JUN83	700	100	8.9	.	.	.	0.003	0.001	0.003	0.001	0.001	.	.
18JUN83	800	106	10.4	0.006	.	0.001	0.004	.	.	0.003	.	0.004	0.003
18JUN83	900	114	10.3	0.015	0.023	0.013	0.017	0.056	0.008	0.01	0.001	0.012	0.014
18JUN83	1000	131	7.3	0.009	0.009	0.006	0.004	0.007	0.005	0.005	0.001	0.004	0.007
18JUN83	1100	130	6.2	0.001	0.001	0.001	0.001	0.003	0.007	0.001	0.001	0.001	0.001
18JUN83	1200	131	7.2	0.005	0.006	0.008	0.011	0.004	0.014	0.008	0.005	0.003	0.004
18JUN83	1300	139	9.7	0.009	0.008	0.011	0.01	0.003	0.011	0.011	0.004	0.006	0.003
18JUN83	1400	152	10.2	0.023	0.01	0.012	0.013	0.026	0.028	0.01	0.003	0.006	0.004
18JUN83	1500	144	9.1	0.010	0.048	0.029	0.038	0.064	0.033	0.015	0.006	0.012	0.011
18JUN83	1600	126	9.1	0.008	0.015	0.014	0.012	0.026	0.008	0.006	0.001	0.001	0.003
18JUN83	1700	131	12.4	0.015	0.03	0.013	0.015	0.028	0.026	0.012	0.003	0.011	0.008
18JUN83	1800	148	14.2	0.029	0.044	0.03	0.035	0.036	0.038	0.021	0.012	0.025	0.025
18JUN83	1900	169	11.5	0.012	0.005	0.006	0.006	0.008	0.004	0.004	0.001	0.001	0.003
18JUN83	2000	182	12.4	0.003	0.001	0.001	.	0.001	0.003	0.001	0.001	0.001	0.001
18JUN83	2100	189	9.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18JUN83	2200	156	7.6	0.009	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18JUN83	2300	152	6.3	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18JUN83	2400	148	6.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
19JUN83	100	144	7.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19JUN83	200	132	6.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
19JUN83	300	136	9.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19JUN83	400	140	9.9	0.003	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.005
19JUN83	500	169	6.6	0.001	0.001	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001
19JUN83	600	171	7	.	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	.
19JUN83	700	171	9	.	.	.	0.001	0.001	0.003	0.001	0.001	.	.
19JUN83	800	135	8	0.001	.	0.001	0.001	.	.	0.001	.	0.001	0.003
19JUN83	900	170	8.4	0.001	0.001	0.001	0.001	0.003	0.005	0.001	0.001	0.001	0.005
19JUN83	1000	208	7.5	0.003	0.003	0.004	0.003	0.001	0.005	0.003	0.001	0.031	0.055
19JUN83	1100	256	4.9	0.001	0.003	0.003	0.001	0.001	0.005	0.003	0.001	0.008	0.009
19JUN83	1200	186	3.5	0.016	0.001	0.003	0.001	0.001	0.005	0.004	0.016	0.072	0.036
19JUN83	1300	105	3.8	0.202	0.001	0.001	0.001	0.001	0.003	0.006	0.009	0.450	0.234
19JUN83	1400	159	7.5	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.016
19JUN83	1500	204	15.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.086	0.048
19JUN83	1600	234	8.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.02
19JUN83	1700	315	10.3	0.001	0.001	0.001	0.001	0.001	0.003	0.006	0.001	0.001	0.031
19JUN83	1800	27	10.1	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
19JUN83	1900	82	6.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19JUN83	2000	93	6.9	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001	0.001
19JUN83	2100	113	11.7	0.003	0.003	0.001	0.005	0.001	0.007	0.001	0.001	0.001	0.003
19JUN83	2200	95	10.5	0.02	0.024	0.017	0.032	0.01	0.034	0.016	0.012	0.019	0.019
19JUN83	2300	103	11.5	0.017	0.02	0.015	0.017	0.008	0.018	0.015	0.008	0.014	0.012
19JUN83	2400	115	11.3	0.006	0.006	0.005	0.005	0.001	0.005	0.005	0.001	0.005	0.003
20JUN83	100	117	11.9	0.003	0.001	0.003	0.004	0.001	0.003	0.003	0.001	0.001	0.001
20JUN83	200	124	9.8	0.001	0.001	0.004	0.006	0.001	0.004	0.001	0.001	0.004	0.001
20JUN83	300	122	8.8	0.003	0.001	0.001	0.005	0.001	0.004	0.001	0.001	0.006	0.001
20JUN83	400	120	10.7	0.003	0.001	0.003	0.005	0.001	0.004	0.001	0.001	0.004	0.001
20JUN83	500	123	10.6	0.003	0.001	0.001	0.005	0.001	0.003	.	0.001	0.001	0.001
20JUN83	600	119	11.2	.	0.001	0.001	0.005	0.001	0.004	0.001	0.001	.	.
20JUN83	700	140	8	.	.	.	0.005	0.001	0.003	0.001	0.001	.	.
20JUN83	800	148	6.5	0.004	.	0.003	0.004	.	.	0.003	.	0.001	0.001
20JUN83	900	151	6.5	0.007	0.001	0.001	0.003	0.001	0.004	0.001	0.001	0.001	0.001
20JUN83	1000	163	6.5	0.009	0.001	0.001	0.003	0.001	0.006	0.004	0.004	0.001	0.001
20JUN83	1100	185	4.6	0.015	0.001	0.001	0.001	0.001	0.001	0.003	0.003	0.001	0.001
20JUN83	1200	188	4.1	0.024	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001
20JUN83	1300	178	6	0.048	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20JUN83	1400	173	6.3	0.095	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001
20JUN83	1500	187	4.7	0.009	0.001	0.001	0.003	0.001	0.003	0.001	0.007	0.001	0.001
20JUN83	1600	187	4.4	0.01	0.001	0.003	0.005	0.001	0.005	0.005	0.01	0.001	0.005
20JUN83	1700	203	4.1	0.01	0.006	0.007	0.007	0.003	0.005	0.006	0.006	0.007	0.011
20JUN83	1800	156	4.3	0.007	0.006	0.005	0.005	0.003	0.004	0.005	0.006	0.004	0.012
20JUN83	1900	106	6.7	0.011	0.004	0.005	0.005	0.001	0.001	0.009	0.015	0.012	0.019
20JUN83	2000	89	6	0.014	0.004	0.012	.	0.005	0.004	0.012	0.013	0.011	0.009
20JUN83	2100	105	7.4	0.008	0.008	0.022	0.017	0.006	0.014	0.011	0.019	0.007	0.004
20JUN83	2200	108	9.6	0.008	0.024	0.016	0.017	0.012	0.014	0.016	0.013	0.012	0.004
20JUN83	2300	104	10.6	0.007	0.015	0.005	0.006	0.009	0.004	0.007	0.009	0.007	0.001
20JUN83	2400	120	10.3	0.006	0.009	0.004	0.006	0.001	0.004	0.004	0.004	0.005	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMMER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
21JUN83	100	80	5.9	0.005	0.006	0.001	0.006	0.001	0.001	0.003	0.001	0.001	0.001
21JUN83	200	56	4	0.003	0.005	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	300	76	6.4	0.001	0.004	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	400	80	8.3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	500	100	11.8	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
21JUN83	600	83	8.4	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
21JUN83	700	47	5.7	.	.	.	0.006	0.001	0.001	0.001	0.001	.	.
21JUN83	800	47	5.7	0.010	.	0.007	0.013	.	.	0.006	.	0.008	0.005
21JUN83	900	76	6	0.036	0.061	0.03	0.037	0.028	0.03	0.031	0.016	0.015	0.016
21JUN83	1000	78	8.3	0.022	0.054	0.025	0.034	0.034	0.046	0.023	0.013	0.014	0.016
21JUN83	1100	70	7.7	0.021	0.025	0.038	0.019	0.017	0.017	0.015	0.014	0.017	0.023
21JUN83	1200	74	8.7	0.043	0.027	0.031	0.023	0.014	0.017	0.02	0.02	0.043	0.053
21JUN83	1300	73	9.6	0.022	0.033	0.054	0.034	0.027	0.011	0.033	0.026	0.025	0.016
21JUN83	1400	79	9.8	0.02	0.029	0.031	0.023	0.021	0.015	0.021	0.015	0.016	0.019
21JUN83	1500	79	9.2	0.011	0.094	0.047	0.005	0.009	0.009	0.007	0.005	0.007	0.013
21JUN83	1600	81	10.5	0.005	0.013	0.006	0.003	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	1700	84	11	0.001	0.145	0.018	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	1800	86	10.1	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	1900	89	9.4	0.011	0.042	0.005	0.004	0.004	0.006	0.004	0.005	0.004	0.006
21JUN83	2000	85	8.2	0.011	0.017	0.003	.	0.001	0.003	0.001	0.001	0.001	0.001
21JUN83	2100	70	9.2	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	2200	64	11.9	0.001	0.014	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21JUN83	2300	68	11.9	0.001	0.012	0.001	0.008	0.004	0.001	0.003	0.003	0.001	0.001
21JUN83	2400	66	10.9	0.001	0.005	0.001	0.001	0.014	0.001	0.001	0.008	0.001	0.001
22JUN83	100	76	8.4	0.001	0.011	0.001	0.003	0.005	0.001	0.001	0.006	0.001	0.001
22JUN83	200	93	9.5	0.001	0.007	0.004	0.004	0.001	0.001	0.001	0.003	0.001	0.001
22JUN83	300	90	9.4	0.001	0.006	0.003	0.005	0.001	0.001	0.001	0.001	0.001	0.001
22JUN83	400	95	7.8	0.001	0.007	0.004	0.007	0.003	0.004	0.001	0.003	0.001	0.001
22JUN83	500	82	6.3	0.001	0.01	0.003	0.007	0.004	0.004	.	0.001	0.001	0.001
22JUN83	600	68	8.2	.	0.012	0.003	0.007	0.005	0.003	0.001	0.003	0.001	.
22JUN83	700	61	9	.	.	.	0.008	0.005	0.004	0.001	0.004	.	.
22JUN83	800	50	7.3	0.008	.	0.013	0.01	.	.	0.004	.	0.006	0.005
22JUN83	900	45	6.4	0.025	0.036	0.019	0.021	0.027	0.02	0.017	0.024	0.02	0.023
22JUN83	1000	61	7.9	0.036	0.038	0.029	0.033	0.033	0.035	0.029	0.036	0.035	0.046
22JUN83	1100	22	11.3	0.038	0.045	0.045	0.005	0.144	0.042	0.030	0.04	0.04	0.032
22JUN83	1200	29	12.7	0.008	0.013	0.011	0.057	0.007	0.012	0.000	0.011	0.007	0.008
22JUN83	1300	42	19	0.005	0.008	0.007	0.078	0.069	0.008	0.005	0.008	0.005	0.006
22JUN83	1400	54	10.2	0.009	0.008	0.021	0.033	0.019	0.01	0.009	0.011	0.007	0.009
22JUN83	1500	73	10.4	0.011	0.012	0.024	0.012	0.013	0.017	0.011	0.016	0.01	0.011
22JUN83	1600	60	10.4	0.011	0.009	0.024	0.014	0.016	0.024	0.016	0.025	0.006	0.005
22JUN83	1700	64	9.2	0.01	0.028	0.043	0.019	0.019	0.008	0.017	0.01	0.015	0.011
22JUN83	1800	76	8.9	0.027	0.02	0.043	0.01	0.005	0.003	0.005	0.005	0.010	0.021
22JUN83	1900	74	7.8	0.032	0.014	0.013	0.005	0.005	0.003	0.005	0.006	0.013	0.024
22JUN83	2000	83	7.2	0.029	0.021	0.015	.	0.003	0.003	0.003	0.004	0.017	0.024
22JUN83	2100	93	8.1	0.006	0.013	0.006	0.003	0.004	0.004	0.001	0.005	0.004	0.004
22JUN83	2200	96	7.7	0.003	0.007	0.007	0.006	0.004	0.006	0.001	0.004	0.003	0.001
22JUN83	2300	82	5.5	0.005	0.007	0.004	0.006	0.004	0.004	0.001	0.004	0.003	0.001
22JUN83	2400	70	7.5	0.001	0.011	0.001	0.006	0.003	0.003	0.001	0.003	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
23JUN83	100	55	10.4	0.003	0.009	0.003	0.007	0.003	0.001	0.001	0.001	0.003	0.001
23JUN83	200	65	10.6	0.003	0.011	0.003	0.008	0.003	0.003	0.001	0.001	0.003	0.001
23JUN83	300	87	10.3	0.009	0.013	0.006	0.012	0.004	0.004	0.004	0.001	0.006	0.007
23JUN83	400	80	7	0.007	0.009	0.005	0.008	0.004	0.005	0.003	0.003	0.005	0.008
23JUN83	500	45	6	0.006	0.007	0.003	0.009	0.003	0.001	.	0.001	0.006	0.012
23JUN83	600	65	5.9	.	0.011	0.001	0.011	0.001	0.001	0.001	0.001	0.012	.
23JUN83	700	87	5.4	.	.	.	0.011	0.001	0.001	0.001	0.001	.	.
23JUN83	800	93	4.9	0.011	.	0.007	0.01	.	.	0.004	.	0.005	0.005
23JUN83	900	123	4.4	0.013	0.011	0.011	0.014	0.01	0.009	0.008	0.003	0.012	0.01
23JUN83	1000	169	3.4	0.048	0.015	0.012	0.016	0.014	0.016	0.01	0.016	0.022	0.056
23JUN83	1100	177	3.2	0.072	0.015	0.016	0.019	0.027	0.015	0.019	0.06	0.152	0.171
23JUN83	1200	294	4.3	0.080	0.017	0.068	0.104	0.201	0.131	0.154	0.082	0.152	0.111
23JUN83	1300	290	5.2	0.055	0.05	0.116	0.279	0.117	0.097	0.09	0.031	0.07	0.068
23JUN83	1400	214	3.9	0.055	0.055	0.097	0.151	0.066	0.033	0.055	0.018	0.06	0.053
23JUN83	1500	.	5	0.027	0.158	0.087	0.032	0.018	0.012	0.013	0.011	0.024	0.017
23JUN83	1600	.	5.4	0.012	0.048	0.013	0.012	0.01	0.009	0.009	0.01	0.011	0.015
23JUN83	1700	120	5.7	0.01	0.016	0.01	0.009	0.005	0.004	0.006	0.005	0.01	0.016
23JUN83	1800	130	5	0.004	0.005	0.006	0.006	0.005	0.007	0.001	0.004	0.004	0.008
23JUN83	1900	94	5.1	0.003	0.007	0.008	0.01	0.009	0.008	0.006	0.004	0.003	0.004
23JUN83	2000	90	5.1	0.003	0.008	0.006	.	0.008	0.004	0.004	0.005	0.003	0.003
23JUN83	2100	112	6.5	0.001	0.006	0.001	0.008	0.004	0.001	0.004	0.004	0.005	0.001
23JUN83	2200	124	6.3	0.001	0.007	0.001	0.007	0.003	0.001	0.003	0.003	0.003	0.001
23JUN83	2300	133	6.4	0.001	0.006	0.001	0.004	0.001	0.001	0.001	0.003	0.001	0.001
23JUN83	2400	104	3.9	0.001	0.004	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
24JUN83	100	174	2.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUN83	200	75	2.6	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
24JUN83	300	306	4.3	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001
24JUN83	400	320	4.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
24JUN83	500	322	5	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
24JUN83	600	289	3.3	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
24JUN83	700	302	2.4	.	.	.	0.003	0.001	0.001	0.001	0.001	.	.
24JUN83	800	69	2.2	0.001	.	0.001	0.004	.	.	0.001	.	0.001	0.001
24JUN83	900	.	3.2	0.003	0.003	0.004	0.008	0.001	0.001	0.001	0.001	0.001	0.001
24JUN83	1000	298	4	0.001	0.008	0.004	0.007	0.003	0.004	0.003	0.001	0.001	0.001
24JUN83	1100	276	3.5	0.011	0.066	0.036	0.041	0.059	0.007	0.011	0.001	0.011	0.005
24JUN83	1200	240	4.5	0.009	0.09	0.052	0.049	0.017	0.008	0.031	0.001	0.013	0.011
24JUN83	1300	223	4.3	0.006	0.145	0.127	0.049	0.011	0.004	0.038	0.001	0.01	0.011
24JUN83	1400	244	4	0.007	0.112	0.202	0.119	0.016	0.003	0.114	0.001	0.012	0.01
24JUN83	1500	203	4.5	0.006	0.239	0.1	0.113	0.051	0.014	0.093	0.014	0.008	0.008
24JUN83	1600	297	7.1	0.005	0.01	0.011	0.031	0.126	0.04	0.01	0.006	0.008	0.009
24JUN83	1700	341	8.1	0.007	0.009	0.01	0.01	0.028	0.015	0.01	0.008	0.01	0.01
24JUN83	1800	335	6.7	0.005	0.009	0.01	0.01	0.01	0.011	0.008	0.004	0.005	0.005
24JUN83	1900	352	8.6	0.001	0.004	0.006	0.005	0.005	0.007	0.006	0.001	0.001	0.001
24JUN83	2000	1	7.6	0.001	0.001	0.004	.	0.003	0.001	0.003	0.001	0.001	0.003
24JUN83	2100	31	6.7	0.001	0.004	0.003	0.005	0.001	0.001	0.001	0.001	0.003	0.001
24JUN83	2200	64	4.4	0.001	0.003	0.001	0.005	0.003	0.001	0.001	0.001	0.001	0.001
24JUN83	2300	140	5.1	0.001	0.003	0.001	0.004	0.001	0.004	0.001	0.001	0.001	0.001
24JUN83	2400	.	5.7	0.001	0.003	0.001	0.004	0.001	0.003	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TONER	SR 65	E. MT. CARMEL	OLD INDIAN
25JUN83	100	102	5.5	0.001	0.003	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
25JUN83	200	100	6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
25JUN83	300	211	5.6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
25JUN83	400	224	3.9	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
25JUN83	500	5	7.7	0.001	0.001	0.001	0.007	0.001	0.001	.	0.001	0.001	0.001
25JUN83	600	43	9.3	.	0.001	0.001	0.01	0.001	0.001	0.001	0.001	0.001	.
25JUN83	700	43	6.8	.	.	.	0.007	0.001	0.001	0.001	0.001	.	.
25JUN83	800	57	4	0.004	.	0.003	0.008	.	.	0.001	.	0.001	0.001
25JUN83	900	59	3.4	0.015	0.012	0.004	0.009	0.006	0.005	0.004	0.004	0.004	0.001
25JUN83	1000	.	3.8	0.006	0.009	0.007	0.011	0.012	0.006	0.003	0.007	0.005	0.003
25JUN83	1100	329	5	0.007	0.007	0.012	0.026	0.011	0.01	0.007	0.01	0.006	0.006
25JUN83	1200	330	6.6	0.006	0.006	0.01	0.076	0.011	0.009	0.006	0.007	0.005	0.004
25JUN83	1300	318	5.1	0.004	0.003	0.043	0.078	0.135	0.01	0.003	0.005	0.003	0.003
25JUN83	1400	260	5.2	0.003	0.013	0.048	0.116	0.129	0.021	0.004	0.007	0.001	0.001
25JUN83	1500	.	5	0.007	0.225	0.046	0.073	0.068	0.014	0.031	0.012	0.007	0.011
25JUN83	1600	.	5.8	0.019	0.096	0.062	0.055	0.012	0.013	0.013	0.016	0.024	0.034
25JUN83	1700	.	6.7	0.034	0.145	0.036	0.018	0.017	0.007	0.017	0.01	0.024	0.034
25JUN83	1800	74	6.7	0.024	0.059	0.034	0.009	0.005	0.004	0.007	0.005	0.014	0.015
25JUN83	1900	83	6.7	0.012	0.05	0.009	0.008	0.005	0.004	0.007	0.007	0.01	0.013
25JUN83	2000	109	9.1	0.009	0.006	0.007	.	0.005	0.001	0.004	0.004	0.006	0.005
25JUN83	2100	123	10.4	0.005	0.005	0.005	0.005	0.003	0.003	0.001	0.004	0.003	0.021
25JUN83	2200	126	10.9	0.004	0.004	0.005	0.006	0.001	0.004	0.001	0.004	0.001	0.001
25JUN83	2300	123	11.8	0.015	0.017	0.006	0.007	0.003	0.006	0.001	0.003	0.003	0.001
25JUN83	2400	129	13.2	0.005	0.008	0.007	0.009	0.003	0.009	0.003	0.003	0.004	0.001
26JUN83	100	133	14.5	0.007	0.008	0.009	0.011	0.003	0.011	0.003	0.005	0.006	0.004
26JUN83	200	.	11.3	0.009	0.007	0.009	0.01	0.001	0.008	0.006	0.006	0.007	0.006
26JUN83	300	141	9.3	0.006	0.008	0.007	0.008	0.003	0.007	0.005	0.005	0.006	0.003
26JUN83	400	119	0.5	0.005	0.008	0.007	0.008	0.001	0.005	0.003	0.005	0.005	0.003
26JUN83	500	122	9.5	0.005	0.007	0.005	0.007	0.003	0.004	.	0.004	0.003	0.004
26JUN83	600	143	6.7	.	0.007	0.004	0.007	0.001	0.003	0.001	0.005	0.003	.
26JUN83	700	157	5.7	.	.	.	0.006	0.001	0.006	0.004	0.003	.	.
26JUN83	800	140	6	0.005	.	0.005	0.007	.	.	0.003	.	0.005	0.003
26JUN83	900	164	4.8	0.005	0.006	0.006	0.007	0.001	0.004	0.004	0.001	0.004	0.001
26JUN83	1000	197	4.8	0.004	0.005	0.005	0.005	0.001	0.004	0.003	0.004	0.025	0.067
26JUN83	1100	206	5.5	0.003	0.003	0.004	0.003	0.001	0.003	0.001	0.001	0.01	0.187
26JUN83	1200	179	7.1	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.003	0.004	0.005
26JUN83	1300	173	7.9	0.011	0.001	0.003	0.001	0.001	0.005	0.001	0.003	0.001	0.001
26JUN83	1400	172	11.3	0.036	0.003	0.006	0.004	0.001	0.005	0.004	0.001	0.004	0.003
26JUN83	1500	164	11.8	0.027	0.001	0.003	0.001	0.001	0.005	0.003	0.007	0.004	0.004
26JUN83	1600	155	13.5	0.011	0.001	0.004	0.003	0.001	0.005	0.005	0.007	0.006	0.007
26JUN83	1700	154	13.6	0.006	0.003	0.005	0.001	0.001	0.004	0.004	0.003	0.006	0.005
26JUN83	1800	166	14.1	0.017	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUN83	1900	174	14.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUN83	2000	195	17.2	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001	0.001
26JUN83	2100	210	14.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.009	0.012
26JUN83	2200	202	10.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.011
26JUN83	2300	105	10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUN83	2400	214	12.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.016	0.019

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUGGIER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
27JUN83	100	241	10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	200	212	6.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	300	172	6.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	400	191	7.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	500	165	6.4	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
27JUN83	600	172	12	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.	.
27JUN83	700	181	14.4	.	.	.	0.001	0.001	0.001	0.001	0.001	.	.
27JUN83	800	187	14	0.001	.	0.001	0.001	.	.	0.001	.	0.001	0.001
27JUN83	900	190	13.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	1000	190	13.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	1100	190	14.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	1200	195	13.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	1300	200	13.6	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
27JUN83	1400	160	16.4	0.007	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
27JUN83	1500	187	14.2	0.001	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	1600	186	13.2	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	1700	183	14.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001
27JUN83	1800	179	12.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.229
27JUN83	1900	186	12.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	2000	211	12.1	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.004	0.001
27JUN83	2100	203	11.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.009	0.02
27JUN83	2200	183	13.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	2300	170	13.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27JUN83	2400	193	14	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	100	180	13.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	200	190	14	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	300	214	15.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.084	0.094
28JUN83	400	243	11.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
28JUN83	500	231	7.7	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
28JUN83	600	192	9.2	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.	.
28JUN83	700	189	11.1	.	.	.	0.001	0.001	0.001	0.001	.	.	.
28JUN83	800	194	12.9	0.001	.	0.001	0.001	.	.	0.001	.	0.025	0.006
28JUN83	900	205	11.5	0.001	0.001	0.001	0.001	0.001	.	0.001	.	0.165	0.119
28JUN83	1000	166	9.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.01	0.001
28JUN83	1100	143	6.4	0.004	0.001	0.001	0.001	.	.	0.001	0.001	0.001	0.001
28JUN83	1200	180	9.9	0.001	0.001	0.001	.	0.001	.	0.001	0.001	0.001	0.001
28JUN83	1300	186	14.4	0.001	0.001	.	.	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	1400	179	15.4	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	1500	190	16.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	1600	180	16.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	1700	184	14.4	0.031	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	1800	.	13.1	0.001	0.001	0.001	0.001	0.004	0.011	0.001	0.001	0.005	0.001
28JUN83	1900	17	4.9	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	2000	83	4.9	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	2100	84	7.3	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	2200	108	10.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	2300	115	7.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28JUN83	2400	132	6.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
29JUN83	100	161	6.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	200	196	7.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	300	190	8.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	400	195	6.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	500	190	9.5	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.006	0.001
29JUN83	600	193	11.6	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
29JUN83	700	197	10.4	.	.	.	.	0.001	.	0.001	.	.	.
29JUN83	800	172	7	0.001	.	0.001	.	.	.	0.001	.	0.004	0.001
29JUN83	900	170	6.7	0.003	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.005	0.001
29JUN83	1000	161	6.2	0.014	0.001	0.003	0.003	0.001	0.001	0.001	0.001	0.003	0.023
29JUN83	1100	143	7.1	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	1200	146	8.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	1300	147	12.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	1400	141	15.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.012	0.017
29JUN83	1500	153	16	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.014	0.019
29JUN83	1600	155	18.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	1700	154	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	1800	164	17.5	0.019	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	1900	.	16.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001
29JUN83	2000	174	14.5	0.016	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.006	0.001
29JUN83	2100	111	7.6	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	2200	157	8.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	2300	143	10.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29JUN83	2400	166	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
30JUN83	100	182	14	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.003	0.001
30JUN83	200	205	15.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.055	0.040
30JUN83	300	210	12.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.044	0.04
30JUN83	400	197	8.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.014	0.001
30JUN83	500	176	9.7	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.005	0.001
30JUN83	600	103	11.3	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
30JUN83	700	189	12.5	0.001	.	.	.	0.001	.	0.001	.	.	0.001
30JUN83	800	195	12.1	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.026	0.001
30JUN83	900	205	12.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.147	0.044
30JUN83	1000	213	10.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.022	0.018
30JUN83	1100	204	10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.077	0.053
30JUN83	1200	210	11.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.019	0.046
30JUN83	1300	221	11.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.052	0.069
30JUN83	1400	212	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.054	0.07
30JUN83	1500	213	10.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.033	0.02
30JUN83	1600	210	11.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.053	0.029
30JUN83	1700	209	12.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.044	0.072
30JUN83	1800	206	11.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.035	0.063
30JUN83	1900	211	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.007
30JUN83	2000	195	10.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.007	0.009
30JUN83	2100	185	10.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.009
30JUN83	2200	101	11.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
30JUN83	2300	103	12.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.009
30JUN83	2400	183	14.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.007

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMMER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
01JUL83	100	104	13.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
01JUL83	200	186	14.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	300	187	14	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	400	191	13.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	500	191	13.2	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
01JUL83	600	193	12.6	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
01JUL83	700	193	12	.	.	.	.	0.001	.	0.001	.	.	.
01JUL83	800	200	10.8	0.001	.	0.001	.	.	.	0.001	.	0.003	0.001
01JUL83	900	204	10.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.021	0.006
01JUL83	1000	210	10.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.109	0.039
01JUL83	1100	227	8.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.007	0.003
01JUL83	1200	211	9.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.021	0.01
01JUL83	1300	229	9.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	1400	229	9.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	1500	219	13.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.022	0.04
01JUL83	1600	214	15.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.022	0.022
01JUL83	1700	218	15.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.035	0.037
01JUL83	1800	222	17.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.026	0.023
01JUL83	1900	210	16.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.014	0.001
01JUL83	2000	211	13.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.015	0.017
01JUL83	2100	193	15.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	2200	193	18.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	2300	199	20.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL83	2400	205	20.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.084	0.001
02JUL83	100	211	20	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.174	0.12
02JUL83	200	210	17.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.147	0.113
02JUL83	300	216	16.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.067	0.129
02JUL83	400	217	12.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.02	0.033
02JUL83	500	217	9.2	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.01	0.011
02JUL83	600	221	6.6	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	.
02JUL83	700	183	7.7	.	.	.	.	0.001	.	0.001	0.001	.	.
02JUL83	800	182	7.9	0.001	.	0.001	.	.	.	0.001	0.001	0.001	0.001
02JUL83	900	183	12.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUL83	1000	195	10.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.039	0.017
02JUL83	1100	209	11.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.064	0.045
02JUL83	1200	207	13.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.03	0.009
02JUL83	1300	198	13.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.019	0.004
02JUL83	1400	187	17.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.007	0.001
02JUL83	1500	201	17.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.021	0.001
02JUL83	1600	207	14.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.025	0.013
02JUL83	1700	199	12.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.013	0.001
02JUL83	1800	175	13.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUL83	1900	188	14.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUL83	2000	184	14.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUL83	2100	137	16.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUL83	2200	188	15.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02JUL83	2300	207	15.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.045	0.018
02JUL83	2400	182	13.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1903

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
03JUL03	100	172	11.3	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
01JUL03	200	164	11.2	0.034	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	300	176	13.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL83	400	176	13.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	500	176	14.3	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
03JUL83	600	172	12	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
03JUL83	700	154	10.5	.	.	.	.	0.001	.	0.001	.	.	.
03JUL03	800	177	16.3	0.009	.	0.001	.	.	.	0.001	.	0.003	0.001
03JUL01	900	191	18.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL83	1000	213	17.8	0.001	0.019	0.001	0.001	0.001	0.006	0.001	0.001	0.021	0.021
01JUL03	1100	200	13.4	0.001	0.022	0.001	0.001	0.001	0.001	0.001	0.001	0.023	0.02
03JUI83	1200	187	17.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	1300	196	18.2	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.044	0.012
03JUL83	1400	169	16.7	0.043	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL01	1500	161	14.2	0.048	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	1600	154	13.4	0.025	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	1700	174	17.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	1800	166	17.7	0.006	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL33	1900	161	15.5	0.023	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL83	2000	172	17.7	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL83	2100	164	17.4	0.017	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	2200	170	10.1	0.016	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	2300	177	19.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
03JUL03	2400	182	10.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	100	186	20	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	200	186	19.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	300	195	14.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL01	400	203	14.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	500	205	15.7	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.021	0.001
04JUL03	600	196	16	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.068	0.001
04JUL83	700	201	17	.	.	.	.	0.001	.	0.001	.	0.006	.
04JUL03	800	207	20	0.001	.	0.001	.	.	.	0.001	.	.	.
04JUL03	900	212	23.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.184	0.055
04JUL03	1000	216	23.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.364	0.293
04JUL03	1100	230	23.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.123	0.115
04JUL83	1200	230	22.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
04JUL81	1300	256	21.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	1400	265	17.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.015
04JUL03	1500	260	18	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	1600	260	20.9	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	1700	262	17.5	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.003	0.007
04JUL83	1800	271	12.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005
04JUL83	1900	275	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JULE3	2000	266	10.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
04JUL83	2100	271	10.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	2200	263	10.7	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	2300	272	11.6	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
04JUL03	2400	294	13.3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.003

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
05JUL83	100	288	12.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUL83	200	304	12.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUL83	300	306	11.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUL83	400	303	7.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUL83	500	291	6.6	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
05JUL83	600	296	6.9	.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
05JUL83	700	306	6.5	.	.	.	.	0.001	.	0.003	.	.	.
05JUL83	800	307	5.5	0.003	.	0.001	.	.	.	0.003	.	0.001	0.001
05JUL83	900	343	9.7	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001
05JUL83	1000	295	10.5	0.001	0.001	0.001	.	.	.	0.001	.	0.001	0.001
05JUL83	1100	295	10.5	0.001	0.001	.	0.001	0.001	0.058	0.003	0.001	0.001	.
05JUL83	1200	334	7.7	.	.	0.001	0.001	0.001	0.092	.	0.001	0.001	0.001
05JUL83	1300	333	11.9	0.001	0.003	0.001	0.001	0.001	0.029	0.001	0.001	0.003	0.001
05JUL83	1400	334	12	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUL83	1500	341	13.2	0.001	0.001	0.001	0.001	0.001	0.024	0.001	0.001	0.005	0.001
05JUL83	1600	346	13.4	0.001	0.001	0.001	0.001	0.001	0.08	0.001	0.001	0.008	0.001
05JUL83	1700	338	13.9	0.001	0.001	0.001	0.001	0.001	0.048	0.001	0.001	0.006	0.001
05JUL83	1800	337	16.8	0.001	0.001	0.001	0.001	0.001	0.02	0.001	0.001	0.001	0.001
05JUL83	1900	333	16.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUL83	2000	333	15.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05JUL83	2100	15	16.3	0.004	0.003	0.001	0.004	0.001	0.007	0.006	0.001	0.009	0.01
05JUL83	2200	25	12.7	0.004	0.009	0.001	0.012	0.003	0.001	0.001	0.001	0.003	0.001
05JUL83	2300	29	11.1	0.001	0.001	0.001	0.017	0.008	0.001	0.001	0.001	0.001	0.001
05JUL83	2400	37	9.3	0.001	0.001	0.001	0.006	0.025	0.001	0.001	0.001	0.001	0.001
06JUL83	100	39	10.6	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001
06JUL83	200	43	10.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	300	35	10.2	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001
06JUL83	400	35	10.4	0.001	0.001	0.003	0.02	0.019	0.001	0.001	0.001	0.001	0.001
06JUL83	500	33	9.3	0.001	0.001	0.005	0.006	0.045	0.001	.	0.001	0.001	0.001
06JUL83	600	12	10.2	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
06JUL83	700	10	10.9	.	.	.	.	0.001	.	0.001	.	.	.
06JUL83	800	12	13.7	0.006	.	0.004	.	.	.	0.001	.	0.005	0.004
06JUL83	900	27	10.7	0.001	0.004	0.003	0.017	0.01	0.001	0.001	0.001	0.001	0.001
06JUL83	1000	11	9.6	0.001	0.001	0.001	0.105	0.138	0.001	0.001	0.001	0.004	0.001
06JUL83	1100	4	11.8	0.001	0.001	0.001	0.041	0.01	0.001	0.001	0.001	0.004	0.001
06JUL83	1200	350	11.9	0.001	0.003	0.001	0.022	0.007	0.001	0.001	0.001	0.003	0.001
06JUL83	1300	322	9.9	0.001	0.004	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	1400	359	14	0.001	0.001	0.001	0.135	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	1500	317	11.4	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	1600	326	11	0.001	0.003	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	1700	332	11.3	0.001	0.003	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	1800	9	10.7	0.001	0.001	0.001	0.014	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	1900	42	10.1	0.001	0.001	0.001	0.006	0.026	0.001	0.001	0.001	0.001	0.001
06JUL83	2000	34	8.8	0.001	0.001	0.001	0.004	0.008	0.001	0.001	0.001	0.001	0.001
06JUL83	2100	31	10.4	0.001	0.003	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	2200	32	10.8	0.001	0.003	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
06JUL83	2300	46	11	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001
06JUL83	2400	64	12	0.001	0.001	0.001	0.006	0.008	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 3 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
07JUL83	100	72	10.1	0.001	0.008	0.004	0.01	0.001	0.001	0.005	0.001	0.003	0.001
07JUL83	200	76	8.9	0.005	0.01	0.003	0.004	0.001	0.001	0.006	0.001	0.007	0.004
07JUL83	300	70	8.7	0.004	0.011	0.001	0.001	0.001	0.001	0.003	0.001	0.007	0.01
07JUL83	400	81	7.4	0.001	0.009	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.004
07JUL83	500	77	7.5	0.001	0.006	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
07JUL83	600	74	8	.	0.005	0.001	0.001	0.001	0.001	.	0.001	0.001	.
07JUL83	700	61	9.2	.	.	.	.	0.001	.	0.001	.	.	.
07JUL83	800	69	7.5	0.004	.	0.001	.	.	.	0.001	.	0.003	0.001
07JUL83	900	.	6	0.019	0.017	0.001	0.001	0.007	0.009	0.003	0.001	0.005	0.004
07JUL83	1000	.	7.3	0.001	0.006	0.001	0.001	0.004	0.001	0.003	0.001	0.005	0.003
07JUL83	1100	76	9.1	0.001	0.049	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001
07JUL83	1200	70	8.3	0.001	0.01	0.013	0.001	0.001	0.001	0.001	0.001	0.001	0.003
07JUL83	1300	69	7.9	0.029	0.011	0.071	0.003	0.001	0.001	0.003	0.001	0.021	0.011
07JUL83	1400	77	8	0.036	0.045	0.135	0.013	0.003	0.001	0.015	0.001	0.035	0.039
07JUL83	1500	64	7.3	0.023	0.047	0.043	0.034	0.02	0.001	0.032	0.009	0.023	0.015
07JUL83	1600	76	7.7	0.018	0.019	0.032	0.011	0.029	0.008	0.033	0.032	0.018	0.013
07JUL83	1700	60	6.9	0.012	0.018	0.052	0.012	0.028	0.006	0.032	0.012	0.016	0.012
07JUL83	1800	67	7.5	0.018	0.025	0.025	0.017	0.014	0.001	0.018	0.001	0.031	0.019
07JUL83	1900	64	6.9	0.005	0.017	0.004	0.003	0.001	0.001	0.003	0.001	0.004	0.004
07JUL83	2000	61	7.2	0.004	0.001	0.005	0.003	0.001	0.001	0.003	0.001	0.004	0.011
07JUL83	2100	91	6	0.013	0.004	0.003	0.001	0.001	0.001	0.001	0.001	0.014	0.014
07JUL83	2200	103	7	0.01	0.015	0.001	0.001	0.001	0.001	0.001	0.001	0.009	0.004
07JUL83	2300	87	7.9	0.009	0.014	0.001	0.001	0.001	0.001	0.001	0.001	0.009	0.003
07JUL83	2400	97	9.3	0.007	0.009	0.004	0.004	0.001	0.001	0.001	0.001	0.008	0.007
08JUL83	100	109	10.7	0.006	0.006	0.001	0.004	0.001	0.001	0.003	0.001	0.005	0.006
08JUL83	200	110	11.1	0.001	0.005	0.001	0.004	0.001	0.001	0.001	0.001	0.007	0.001
08JUL83	300	114	12.3	0.001	0.004	0.001	0.003	0.001	0.001	0.001	0.001	0.005	0.001
08JUL83	400	114	13	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
08JUL83	500	116	10.7	0.001	0.005	0.001	0.003	0.001	0.001	.	0.001	0.003	0.001
08JUL83	600	122	9.7	.	0.007	0.005	0.01	0.001	0.014	.	0.001	0.001	.
08JUL83	700	123	9	.	.	.	.	0.001	.	0.001	.	.	.
08JUL83	800	108	6.1	0.009	.	0.01	.	.	.	0.008	.	0.011	0.005
08JUL83	900	.	3.8	0.017	0.011	0.011	0.012	0.009	0.008	0.012	0.006	0.014	0.01
08JUL83	1000	205	3.5	0.011	0.021	0.008	0.009	0.012	0.006	0.008	0.004	0.011	0.008
08JUL83	1100	208	3.4	0.008	0.021	0.01	0.01	0.024	0.01	0.007	0.001	0.014	0.042
08JUL83	1200	275	3.5	0.011	0.01	0.012	0.012	0.014	0.013	0.026	0.101	0.011	0.008
08JUL83	1300	282	4.2	0.004	0.007	0.012	0.025	0.007	0.191	0.047	0.016	0.007	0.017
08JUL83	1400	218	4.3	0.011	0.005	0.171	0.21	0.011	0.118	0.163	0.022	0.062	0.099
08JUL83	1500	201	3.4	0.168	0.037	0.305	0.315	0.219	0.049	0.246	0.07	0.195	0.046
08JUL83	1600	290	3.1	0.254	0.063	0.597	0.37	0.171	0.026	0.398	0.062	0.215	0.05
08JUL83	1700	319	4.5	0.53	0.128	0.23	0.151	0.114	0.026	0.294	0.028	0.196	0.054
08JUL83	1800	9	3.5	0.251	0.096	0.186	0.205	0.085	0.091	0.114	0.018	0.097	0.066
08JUL83	1900	.	2.6	0.159	0.065	0.12	0.115	0.093	0.05	0.055	0.017	0.07	0.059
08JUL83	2000	38	4.1	0.111	0.062	0.102	0.109	0.075	0.023	0.042	0.015	0.076	0.044
08JUL83	2100	43	3.6	0.036	0.066	0.098	0.093	0.046	0.018	0.03	0.011	0.05	0.047
08JUL83	2200	118	3.3	0.05	0.008	0.029	0.089	0.037	0.007	0.013	0.011	0.028	0.028
08JUL83	2300	40	2.4	0.039	0.078	0.027	0.051	0.045	0.001	0.012	0.006	0.027	0.023
08JUL83	2400	1	2.6	0.025	0.063	0.029	0.047	0.032	0.001	0.005	0.004	0.015	0.016

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
09JUL83	100	88	4.5	0.017	0.052	0.019	0.041	0.029	0.001	0.007	0.001	0.011	0.009
09JUL83	200	119	5.4	0.01	0.033	0.006	0.016	0.019	0.001	0.007	0.001	0.007	0.009
09JUL83	300	208	3.7	0.005	0.031	0.001	0.005	0.005	0.001	0.005	0.001	0.005	0.006
09JUL83	400	224	4.4	0.004	0.022	0.001	0.004	0.001	0.001	0.003	0.001	0.001	0.006
09JUL83	500	230	4.4	0.005	0.015	0.001	0.003	0.001	0.001	.	0.001	0.001	0.005
09JUL83	600	231	4.5	.	0.011	0.001	0.001	0.001	0.001	.	0.001	0.001	.
09JUL83	700	258	4.4	.	.	.	.	0.001	.	0.001	.	.	.
09JUL83	800	278	3.9	0.006	.	0.001	.	.	.	0.003	.	0.004	0.003
09JUL83	900	201	5.1	0.003	0.004	0.003	0.003	0.003	0.001	0.004	0.001	0.001	0.004
09JUL83	1000	276	5.9	0.004	0.005	0.004	0.005	0.004	0.003	0.005	0.01	0.001	0.005
09JUL83	1100	266	5.7	0.004	0.005	0.003	0.005	0.004	0.004	0.004	0.01	0.001	0.005
09JUL83	1200	312	5.9	0.007	0.009	0.007	0.009	0.007	0.009	0.025	0.009	0.008	0.01
09JUL83	1300	345	7	0.012	0.014	0.014	0.015	0.01	0.016	0.015	0.009	0.012	0.011
09JUL83	1400	317	5.6	0.013	0.022	0.010	0.018	0.016	0.076	0.015	0.01	0.012	0.016
09JUL83	1500	284	3.7	0.012	0.010	0.018	0.019	0.018	0.049	0.08	0.011	0.012	0.017
09JUL83	1600	224	3.3	0.012	0.011	0.015	0.015	0.01	0.015	0.053	0.074	0.011	0.014
09JUL83	1700	183	2.6	0.005	0.008	0.019	0.026	0.006	0.014	0.033	0.021	0.008	0.011
09JUL83	1800	127	3.1	0.006	0.008	0.009	0.026	0.009	0.032	0.019	0.007	0.006	0.009
09JUL83	1900	73	2.3	0.006	0.007	0.005	0.008	0.009	0.03	0.013	0.004	0.005	0.007
09JUL83	2000	11	3.8	0.003	0.004	0.003	0.004	0.003	0.008	0.006	0.003	0.001	0.003
09JUL83	2100	312	2.1	0.001	0.004	0.001	0.005	0.001	0.004	0.003	0.001	0.001	0.001
09JUL83	2200	64	1.8	0.001	0.003	0.001	0.001	0.001	0.003	0.003	0.001	0.001	0.001
09JUL83	2300	.	3.2	0.001	0.003	0.001	0.001	0.001	0.003	0.003	0.001	0.001	0.001
09JUL83	2400	8	8.7	0.001	0.004	0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.001
10JUL83	100	22	4.6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
10JUL83	200	122	2.9	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10JUL83	300	218	2.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10JUL83	400	225	2.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10JUL83	500	253	3.5	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
10JUL83	600	281	2.9	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
10JUL83	700	254	2.7	.	.	.	.	0.001	.	0.001	.	.	.
10JUL83	800	244	3	0.001	.	0.003	.	.	.	0.001	.	0.001	0.001
10JUL83	900	304	1.9	0.004	0.005	0.006	0.006	0.001	0.001	0.003	0.001	0.004	0.001
10JUL83	1000	279	2.5	0.004	0.007	0.009	0.008	0.004	0.006	0.01	0.004	0.012	0.008
10JUL83	1100	279	2.3	0.001	0.005	0.005	0.004	0.001	0.004	0.015	0.003	0.003	0.001
10JUL83	1200	250	3.6	0.009	0.013	0.008	0.007	0.008	0.018	0.021	0.007	0.009	0.012
10JUL83	1300	238	3.5	0.01	0.015	0.013	0.013	0.011	0.051	0.027	0.008	0.008	0.009
10JUL83	1400	213	3.4	0.009	0.015	0.013	0.012	0.011	0.034	0.038	0.075	0.008	0.008
10JUL83	1500	291	3.0	0.009	0.014	0.013	0.012	0.01	0.010	0.043	0.144	0.009	0.009
10JUL83	1600	205	3.6	0.008	0.014	0.011	0.022	0.01	0.031	0.025	0.043	0.009	0.009
10JUL83	1700	.	4	0.008	0.013	0.01	0.029	0.011	0.072	0.017	0.026	0.006	0.009
10JUL83	1800	53	4.3	0.008	0.012	0.009	0.014	0.01	0.064	0.01	0.032	0.007	0.01
10JUL83	1900	45	5.1	0.006	0.009	0.007	0.013	0.008	0.025	0.009	0.011	0.006	0.009
10JUL83	2000	80	3.5	0.005	0.007	0.005	0.003	0.006	0.022	0.007	0.005	0.003	0.004
10JUL83	2100	96	3.9	0.004	0.01	0.003	0.003	0.003	0.026	0.003	0.005	0.001	0.001
10JUL83	2200	.	5.4	0.001	0.013	0.001	0.017	0.005	0.023	0.01	0.003	0.001	0.001
10JUL83	2300	189	6.1	0.001	0.016	0.001	0.033	0.013	0.024	0.014	0.003	0.001	0.001
10JUL83	2400	216	8.6	0.003	0.008	0.001	0.014	0.004	0.018	0.01	0.005	0.011	0.004

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
11JUL83	100	234	8.8	0.005	0.006	0.001	0.006	0.003	0.007	0.005	0.007	0.006	0.007
11JUL83	200	245	7.8	0.001	0.005	0.001	0.003	0.001	0.001	0.003	0.003	0.001	0.004
11JUL83	300	253	5.6	0.001	0.004	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001
11JUL83	400	239	4.5	0.001	0.003	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001
11JUL83	500	250	4.6	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
11JUL83	600	261	4.7	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
11JUL83	700	271	5.1	.	.	.	.	0.001	.	0.001	.	.	.
11JUL83	800	259	4.8	0.001	.	0.001	.	.	.	0.003	.	0.001	0.001
11JUL83	900	261	6.4	0.001	0.004	0.001	0.004	0.004	0.003	0.003	0.001	0.001	0.012
11JUL83	1000	255	6.3	0.003	0.006	0.004	0.006	0.004	0.006	0.005	0.001	0.003	0.015
11JUL83	1100	265	8	0.001	0.004	0.003	0.005	0.004	0.006	0.005	0.001	0.001	0.006
11JUL83	1200	258	7.6	0.001	0.006	0.004	0.005	0.004	0.005	.	0.001	0.001	0.006
11JUL83	1300	243	7.2	0.004	0.008	0.008	0.007	0.005	0.01	.	0.004	0.005	0.007
11JUL83	1400	260	6.4	0.003	0.010	0.007	0.009	0.005	0.011	.	0.062	0.004	0.006
11JUL83	1500	196	6.1	0.003	0.005	0.005	0.005	0.004	.	0.001	0.125	0.005	0.005
11JUL83	1600	212	4.5	0.003	0.004	0.004	0.005	0.003	.	0.004	0.095	0.016	0.041
11JUL83	1700	169	3.3	0.001	0.003	0.004	0.004	0.001	.	0.003	0.009	0.003	0.053
11JUL83	1800	221	8.6	0.001	0.003	0.004	0.004	.	0.001	0.004	0.004	0.001	0.022
11JUL83	1900	223	10.9	0.001	0.004	0.005	0.005	0.003	0.003	0.004	0.004	0.001	0.003
11JUL83	2000	217	10.5	0.001	0.005	0.005	0.006	0.008	0.004	0.006	0.005	0.003	0.003
11JUL83	2100	201	11.7	0.001	0.006	0.006	0.007	0.003	0.004	0.007	0.004	0.03	0.012
11JUL83	2200	209	11.2	0.001	0.005	0.005	0.006	0.003	0.004	0.006	0.003	0.016	0.01
11JUL83	2300	216	10.4	0.001	0.005	0.004	0.005	0.001	0.003	0.005	0.003	0.005	0.008
11JUL83	2400	205	8.9	0.001	0.005	0.003	0.004	0.001	0.001	0.005	0.001	0.005	0.005
12JUL83	100	211	8.6	0.001	0.004	0.001	0.005	0.001	0.001	0.004	0.001	0.005	0.004
12JUL83	200	213	8.1	0.001	0.003	0.001	0.004	0.001	0.001	0.005	0.001	0.003	0.003
12JUL83	300	210	7.6	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.004	0.001
12JUL83	400	230	7.5	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001
12JUL83	500	234	7.8	0.001	0.001	0.001	0.003	0.001	0.001	.	0.001	0.001	0.001
12JUL83	600	233	6.9	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.008	.
12JUL83	700	242	6.7	.	.	.	.	.	.	0.004	.	.	.
12JUL83	800	241	6.5	0.001	.	0.001	.	.	.	0.005	.	0.003	0.003
12JUL83	900	256	7.4	0.004	0.003	0.004	.	0.001	0.001	0.004	.	0.004	0.015
12JUL83	1000	263	6.8	0.003	0.003	0.005	.	0.001	0.001	0.004	0.001	0.004	0.004
12JUL83	1100	269	5.6	0.000	0.007	0.009	.	0.007	0.004	0.007	0.003	0.01	0.009
12JUL83	1200	260	5.3	0.008	0.01	.	.	0.008	0.006	0.01	0.005	0.01	0.011
12JUL83	1300	228	3.8	0.005	0.004	0.019	0.007	0.006	0.032	0.008	0.071	.	0.007
12JUL83	1400	193	3.7	0.003	0.005	0.007	0.007	0.004	0.074	0.006	0.256	0.032	0.001
12JUL83	1500	300	3.7	0.003	.	0.007	0.007	0.003	0.008	0.008	0.044	0.018	0.000
12JUL83	1600	295	3.8	0.001	.	0.005	0.006	0.001	0.001	0.01	0.071	0.003	0.005
12JUL83	1700	276	2.8	.	0.001	0.003	0.005	0.001	0.001	0.005	0.07	0.001	0.001
12JUL83	1800	255	3.6	0.001	0.001	0.001	0.004	0.001	0.001	0.003	0.016	0.001	.
12JUL83	1900	.	7.5	0.001	0.001	0.001	0.006	0.001	0.001	0.004	0.004	0.001	0.001
12JUL83	2000	202	9.2	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.001
12JUL83	2100	202	9.7	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.005	0.001
12JUL83	2200	215	10.0	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.001
12JUL83	2300	217	9.6	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.001
12JUL83	2400	225	9.1	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
13JUL83	100	228	6.9	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001
13JUL83	200	209	5.6	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001
13JUL83	300	216	6.2	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.001
13JUL83	400	.	4.7	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001
13JUL83	500	283	2.6	0.001	0.001	0.001	0.003	0.001	0.001	.	0.001	0.001	0.001
13JUL83	600	85	2.8	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
13JUL83	700	232	4.3	.	.	.	.	.	.	0.003	.	.	.
13JUL83	800	244	6.3	0.001	.	0.001	.	.	.	0.005	.	0.001	0.001
13JUL83	900	251	7.2	0.001	0.005	0.001	0.003	0.001	0.001	0.005	0.001	0.003	0.006
13JUL83	1000	267	5.7	0.001	0.004	0.001	0.004	0.003	0.001	0.005	0.001	0.004	0.001
13JUL83	1100	270	9.3	0.001	0.007	0.003	0.005	0.004	0.001	0.005	0.001	0.005	0.004
13JUL83	1200	271	5.8	0.004	0.008	0.005	0.007	0.006	0.003	0.004	0.001	0.006	0.007
13JUL83	1300	262	6	0.003	0.006	0.005	0.008	0.005	0.003	0.005	0.001	0.006	0.075
13JUL83	1400	248	4.5	0.001	0.006	0.005	0.007	0.004	0.003	0.007	0.001	0.021	0.121
13JUL83	1500	211	5.2	0.001	0.006	0.004	0.006	0.004	0.001	0.006	0.001	0.007	0.041
13JUL83	1600	256	5.7	0.001	0.006	0.005	0.006	0.005	0.003	0.007	0.001	0.018	0.026
13JUL83	1700	211	6.1	0.001	0.006	0.003	0.007	0.004	0.004	0.008	0.003	0.005	0.011
13JUL83	1800	172	5.6	0.001	0.006	0.003	0.006	0.003	0.001	0.007	0.003	0.004	0.004
13JUL83	1900	174	7.8	0.001	0.004	0.001	0.005	0.003	0.001	0.007	0.001	0.001	0.001
13JUL83	2000	196	8.8	0.001	0.005	0.001	0.006	0.003	0.001	0.008	0.001	0.003	0.001
13JUL83	2100	235	8	0.001	0.006	0.001	0.006	0.001	0.001	0.005	0.001	0.003	0.001
13JUL83	2200	242	7.1	0.001	0.006	0.001	0.005	0.001	0.001	0.007	0.001	0.003	0.001
13JUL83	2300	218	7.7	0.001	0.006	0.001	0.005	0.001	0.001	0.005	0.001	0.003	0.001
13JUL83	2400	229	6.7	0.001	0.004	0.001	0.005	0.001	0.001	0.007	0.001	0.004	0.001
14JUL83	100	246	5.2	0.001	0.004	0.001	0.004	0.001	0.001	0.006	0.001	0.003	0.001
14JUL83	200	241	3.8	0.001	0.003	0.001	0.004	0.001	0.001	0.004	0.001	0.001	0.001
14JUL83	300	227	3.9	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001	0.001	0.001
14JUL83	400	223	4.2	0.001	0.001	0.001	0.004	0.001	0.001	0.003	0.001	0.001	0.001
14JUL83	500	229	3.9	0.001	0.001	0.001	0.003	0.001	0.001	.	0.001	0.001	0.001
14JUL83	600	280	1.3	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
14JUL83	700	311	5	.	.	.	.	.	.	0.003	.	.	.
14JUL83	800	2	1.6	0.001	.	0.001	.	.	.	0.005	.	0.001	0.001
14JUL83	900	107	3.4	0.001	0.001	0.001	0.006	0.001	0.003	0.005	0.001	0.004	0.001
14JUL83	1000	150	3.6	0.005	0.006	0.001	0.009	0.004	0.005	0.007	0.001	0.007	0.004
14JUL83	1100	190	3.8	0.011	0.01	0.001	0.008	0.001	0.004	0.007	0.001	0.007	0.001
14JUL83	1200	174	7.5	0.005	0.001	0.003	0.005	0.001	0.001	0.004	0.001	0.004	0.001
14JUL83	1300	169	8.3	0.001	0.001	0.003	0.005	0.001	0.001	0.004	0.001	0.001	0.001
14JUL83	1400	202	6.9	0.001	0.004	0.003	0.006	0.001	0.001	0.005	0.001	0.003	0.001
14JUL83	1500	197	6.3	0.001	0.003	0.005	0.007	0.001	0.001	0.005	0.001	0.004	0.012
14JUL83	1600	220	5.2	0.001	0.001	0.003	0.005	0.001	0.001	0.005	0.001	0.003	0.001
14JUL83	1700	253	6.1	0.001	0.001	0.001	0.005	0.001	0.001	0.005	0.001	0.001	0.001
14JUL83	1800	177	5.5	0.001	0.001	0.001	0.004	0.001	0.001	0.005	0.001	0.001	0.001
14JUL83	1900	151	6.8	0.001	0.001	0.001	0.004	0.001	0.001	0.005	0.001	0.001	0.001
14JUL83	2000	209	6.2	0.098	0.001	0.001	0.004	0.001	0.001	0.005	0.001	0.001	0.001
14JUL83	2100	173	3.7	0.034	0.001	0.001	0.004	0.001	0.001	0.003	0.001	0.001	0.106
14JUL83	2200	225	7.2	0.018	0.001	0.001	0.004	0.001	0.001	0.003	0.001	0.004	0.015
14JUL83	2300	223	8	0.01	0.001	0.001	0.004	0.001	0.001	0.003	0.001	0.004	0.001
14JUL83	2400	221	7.5	0.005	0.001	0.001	0.004	0.001	0.001	0.003	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
15JUL83	100	189	6.5	0.001	0.001	0.001	0.004	0.001	0.001	0.003	0.001	0.001	0.001
15JUL83	200	183	6.6	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001	0.001	0.001
15JUL83	300	192	5.2	0.001	0.001	0.001	0.005	0.001	0.001	0.003	0.001	0.001	0.001
15JUL83	400	183	5.7	0.001	0.001	0.001	0.004	0.001	0.001	0.003	0.001	0.001	0.001
15JUL83	500	172	5.5	0.001	0.001	0.001	0.005	0.001	0.001	.	0.001	0.001	0.001
15JUL83	600	163	6.1	.	0.001	0.001	0.005	0.001	0.001	.	0.001	0.001	.
15JUL83	700	171	6.1	.	.	.	.	.	.	0.003	.	.	.
15JUL83	800	206	7.9	0.001	.	0.001	.	.	.	0.003	.	0.005	0.001
15JUL83	900	215	5.4	0.001	0.001	0.001	0.005	0.001	0.001	0.003	.	0.004	0.001
15JUL83	1000	242	3.8	0.001	0.001	.	.	.	.	0.003	0.001	.	0.001
15JUL83	1100	.	.	.	.	0.001	0.003	0.001	0.001	0.001	0.001	0.001	.
15JUL83	1200	.	7.3	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.001
15JUL83	1300	253	8	0.001	0.001	0.001	0.003	0.001	0.001	.	0.001	0.001	0.001
15JUL83	1400	275	6.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	1500	273	6.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	1600	290	6.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	1700	279	7.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	1800	273	8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	1900	304	6.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	2000	.	4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	2100	351	5.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	2200	331	4.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	2300	279	7.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15JUL83	2400	268	5.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	100	240	4.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	200	246	6.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	300	240	5.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	400	250	6.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	500	265	3.1	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
16JUL83	600	220	3.5	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
16JUL83	700	260	4.7	.	.	.	.	.	.	0.001	.	.	.
16JUL83	800	275	4.8	0.001	.	0.001	.	.	.	0.001	.	0.001	0.001
16JUL83	900	310	5.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	1000	324	5.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	1100	291	8	0.001	0.003	0.003	0.004	0.01	0.009	0.007	0.011	0.005	0.001
16JUL83	1200	278	9.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.044	0.001	0.001
16JUL83	1300	270	8.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.001	0.001
16JUL83	1400	274	8.6	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.094	0.001	0.001
16JUL83	1500	276	8.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	1600	205	10.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.016	0.001	0.001
16JUL83	1700	.	9.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	1800	.	5	0.016	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.053	0.001
16JUL83	1900	.	5.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.021	0.026
16JUL83	2000	269	8.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004
16JUL83	2100	264	7.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004
16JUL83	2200	220	6.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	2300	226	9.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16JUL83	2400	247	10.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
17JUL83	100	254	8.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	200	265	7.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	300	273	7.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	400	284	7.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	500	287	7	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
17JUL83	600	283	7	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
17JUL83	700	293	6.3	.	.	.	.	.	.	0.001	.	.	.
17JUL83	800	272	6	0.001	.	0.001	.	.	.	0.001	.	0.001	0.001
17JUL83	900	281	5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	1000	304	5.6	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	1100	323	5.3	0.001	0.003	0.004	0.003	0.003	0.004	0.001	0.001	0.009	0.001
17JUL83	1200	293	5.3	0.001	0.001	0.004	0.003	0.001	0.003	0.001	0.001	0.004	0.001
17JUL83	1300	252	6.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.109	0.001	0.001
17JUL83	1400	263	10.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.007	0.001	0.001
17JUL83	1500	278	11.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	1600	299	9.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
17JUL83	1700	233	5.6	0.003	0.005	0.003	0.007	0.006	0.001	0.001	0.001	0.005	0.006
17JUL83	1800	218	6.9	0.003	0.005	0.006	0.008	0.006	0.001	0.001	0.001	0.006	0.003
17JUL83	1900	267	8.6	0.001	0.001	0.003	0.005	0.004	0.005	0.001	0.001	0.003	0.009
17JUL83	2000	254	7.5	0.001	0.001	0.001	0.004	0.003	0.001	0.001	0.001	0.001	0.001
17JUL83	2100	213	7.8	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.031
17JUL83	2200	230	9.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	2300	226	8.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
17JUL83	2400	242	9.4	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.003	0.004
18JUL83	100	246	10.4	0.001	0.001	0.001	0.003	0.001	0.003	0.001	0.001	0.001	0.009
18JUL83	200	250	8.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
18JUL83	300	243	9.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18JUL83	400	256	9.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18JUL83	500	250	10.9	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.008
18JUL83	600	262	8	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	.
18JUL83	700	295	9.1	.	.	.	.	.	.	0.003	.	.	.
18JUL83	800	281	9.1	0.001	.	0.001	.	.	.	0.001	.	0.001	0.001
18JUL83	900	264	7.1	0.001	0.001	0.001	0.003	0.005	0.003	0.001	0.001	0.003	0.001
18JUL83	1000	287	6	0.005	0.016	0.006	0.014	0.022	0.017	0.009	0.001	0.008	0.005
18JUL83	1100	276	4.4	0.01	0.007	0.006	0.013	0.013	0.019	0.015	0.001	0.014	0.006
18JUL83	1200	242	3.1	0.007	0.005	0.004	0.011	0.007	0.011	0.015	0.001	0.012	0.001
18JUL83	1300	197	3.5	0.032	0.004	0.005	0.011	0.007	0.007	0.014	0.161	0.094	0.001
18JUL83	1400	248	3.9	0.008	0.001	0.003	.	0.003	0.006	0.004	0.03	0.108	0.306
18JUL83	1500	234	7.1	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.005	0.054
18JUL83	1600	258	10.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
18JUL83	1700	254	11	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
18JUL83	1800	245	12.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
18JUL83	1900	247	12.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18JUL83	2000	246	11.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18JUL83	2100	225	11.7	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
18JUL83	2200	210	13	0.001	0.003	0.001	0.006	0.003	0.008	0.004	0.001	0.019	0.011
18JUL83	2300	224	12	0.001	0.003	0.001	0.008	0.003	0.004	0.005	0.001	0.007	0.003
18JUL83	2400	236	11.4	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.003	0.004

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
19JUL83	100	237	10.3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	200	236	9.8	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	300	229	10.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	400	231	9.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	500	249	8.2	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
19JUL83	600	238	8.6	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
19JUL83	700	262	7.4	.	.	.	0.001	.	.	0.001	.	.	0.001
19JUL83	800	265	7.3	0.001	.	0.001	.	.	.	0.001	.	0.001	0.001
19JUL83	900	265	4.9	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001	.
19JUL83	1000	266	4.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	1100	291	4.5	0.004	0.004	0.001	0.003	0.003	0.003	0.003	0.001	0.01	0.009
19JUL83	1200	328	9.6	0.006	0.005	0.001	0.008	0.008	0.009	0.005	0.001	0.013	0.005
19JUL83	1300	311	9.5	0.003	0.003	0.003	0.01	0.006	0.006	0.012	0.001	0.006	0.001
19JUL83	1400	318	7.6	0.001	0.001	0.003	0.006	0.001	0.001	0.039	0.001	0.004	0.001
19JUL83	1500	.	.	0.001	0.003	.	0.009	0.001	0.001	0.001	0.022	.	0.001
19JUL83	1600	.	.	0.001	0.001	.	0.007	0.001	0.001	0.001	.	.	0.001
19JUL83	1700	282	9.3	0.001	0.001	0.001	0.008	0.001	0.001	0.004	0.027	0.001	0.001
19JUL83	1800	286	9.3	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.004	0.001	0.001
19JUL83	1900	277	10.1	0.001	0.001	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	2000	277	9.6	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	2100	267	9.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	2200	253	10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	2300	257	10.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
19JUL83	2400	234	8.4	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	100	262	10.9	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	200	277	9.5	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	300	266	8	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	400	252	6.4	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	500	260	7.9	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	600	66	7.3	.	0.001	0.001	0.004	0.001	0.001	.	0.001	0.001	0.001
20JUL83	700	97	7.4	.	.	0.001	0.006	.	.	.	0.001	.	0.001
20JUL83	800	132	5	0.001	.	.	.	.	.	0.003	.	.	0.001
20JUL83	900	141	3.4	0.001	0.004	0.001	.	0.003	0.001	0.001	.	0.001	.
20JUL83	1000	241	7.3	0.001	0.003	0.001	0.005	0.001	0.001	0.001	0.001	0.004	0.003
20JUL83	1100	285	7.3	0.001	0.001	0.001	0.006	0.001	0.001	0.003	0.001	0.004	0.005
20JUL83	1200	292	9.4	0.001	0.001	0.001	0.01	0.003	0.001	0.009	0.001	0.008	0.004
20JUL83	1300	286	10.5	0.001	0.001	0.001	0.01	0.003	0.004	0.001	0.01	0.006	0.001
20JUL83	1400	271	11.4	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	1500	269	10.9	0.001	0.001	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	1600	275	11.4	0.001	0.001	0.001	0.013	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	1700	265	12.6	0.001	0.001	0.001	0.012	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	1800	268	12.1	0.001	0.001	0.001	0.015	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	1900	272	8.5	0.001	0.001	0.001	0.011	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	2000	266	9	0.001	0.001	0.001	0.009	0.003	0.009	0.001	0.001	0.001	0.001
20JUL83	2100	269	9.4	0.001	0.001	0.001	0.005	0.003	0.007	0.001	0.001	0.001	0.001
20JUL83	2200	273	8	0.001	0.001	0.001	0.004	0.001	0.003	0.001	0.001	0.001	0.001
20JUL83	2300	229	3.7	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
20JUL83	2400	218	5.7	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
21JUL83	100	218	9.4	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	200	229	11.6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	300	246	11.3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	400	246	11.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.007
21JUL83	500	249	10.4	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.003
21JUL83	600	243	8.4	.	0.001	0.001	0.003	0.001	0.001	.	0.001	0.001	0.001
21JUL83	700	238	7	.	.	0.001	0.003	.	.	.	0.001	0.001	0.001
21JUL83	800	269	6	0.001	.	.	.	.	.	0.001	.	.	0.001
21JUL83	900	315	6.5	0.001	0.001	0.001	.	0.001	0.001	0.001	.	0.001	.
21JUL83	1000	331	9.3	0.001	0.001	0.001	0.003	0.001	0.005	0.001	0.001	0.018	0.001
21JUL83	1100	322	7.8	0.001	0.001	0.001	0.003	0.001	0.023	0.001	0.001	0.009	0.001
21JUL83	1200	313	7.1	0.001	0.001	0.001	0.003	0.001	0.001	0.009	0.001	0.001	0.001
21JUL83	1300	259	6.5	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	1400	263	10.2	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	1500	262	10.9	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	1600	264	10.8	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	1700	256	11.8	0.001	0.001	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	1800	265	12.4	0.001	0.001	0.001	0.012	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	1900	260	12.7	0.001	0.001	0.001	0.012	0.001	0.001	0.001	0.001	0.001	0.011
21JUL83	2000	246	11.7	0.001	0.001	0.001	0.01	0.001	0.001	0.001	0.001	0.001	0.015
21JUL83	2100	234	12	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	2200	234	12.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21JUL83	2300	246	10.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.036
21JUL83	2400	236	7.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.01
22JUL83	100	246	5.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	200	282	3.7	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	300	241	5.6	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	400	228	6.8	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	500	234	6.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	600	253	6.5	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
22JUL83	700	257	5.7	.	.	0.001	0.001	.	.	.	0.001	.	0.001
22JUL83	800	286	9.4	0.001	.	.	.	.	.	0.001	.	.	0.001
22JUL83	900	305	9.6	0.001	0.001	0.001	.	0.001	0.001	0.001	.	0.001	.
22JUL83	1000	319	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
22JUL83	1100	333	8.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.011	0.001
22JUL83	1200	302	8.4	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001
22JUL83	1300	275	9.6	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.021	0.001	0.001
22JUL83	1400	275	11.9	0.001	0.001	0.001	0.004	0.001	0.001	0.006	0.011	0.001	0.001
22JUL83	1500	266	12.1	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.003	0.001	0.001
22JUL83	1600	261	12.8	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	1700	270	12.4	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	1800	267	11.8	0.001	0.001	0.001	0.011	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	1900	274	10	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	2000	278	9.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	2100	260	9.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	2200	244	10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	2300	232	9.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
22JUL83	2400	234	12	0.001	0.003	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
23JUL83	100	230	13	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	200	225	14	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	300	220	9.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	400	224	8.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	500	232	9.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	600	242	7.5	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
23JUL83	700	242	9.5	.	.	0.001	0.001	.	.	.	0.001	0.001	0.001
23JUL83	000	255	9.1	0.001	.	.	.	.	.	0.001	.	.	0.001
23JUL83	900	281	8.8	0.001	0.006	0.001	.	0.003	0.006	0.001	.	0.005	.
23JUL83	1000	287	10.7	0.006	0.01	0.004	0.001	0.008	0.01	0.004	0.012	0.01	0.004
23JUL83	1100	301	13.2	0.007	0.013	0.008	0.001	0.012	0.013	0.010	0.006	0.01	0.009
23JUL83	1200	307	14.7	0.001	0.007	0.005	0.001	0.004	0.006	0.007	0.001	0.005	0.003
23JUL83	1300	294	14.5	0.001	0.003	0.003	0.001	0.001	0.004	0.012	0.001	0.001	0.001
23JUL83	1400	291	13	0.001	0.003	0.001	0.001	0.001	0.001	0.019	0.041	0.001	0.001
23JUL83	1500	267	12.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001
23JUL83	1600	265	12.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001
23JUL83	1700	264	12.5	0.001	0.003	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	1800	257	14.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.009
23JUL83	1900	256	12.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.027
23JUL83	2000	243	11.4	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
23JUL83	2100	231	13	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	2200	229	13	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	2300	218	11.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
23JUL83	2400	218	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	100	223	12.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	200	240	13.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	300	288	9	0.001	0.001	0.001	0.001	0.001	0.001	0.011	0.004	0.001	0.001
24JUL83	400	267	9.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.003
24JUL83	500	298	10.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	600	360	11.3	.	0.003	0.001	0.001	0.001	0.001	.	0.001	0.008	0.001
24JUL83	700	17	12.4	.	.	0.004	0.003	.	.	.	0.001	0.005	0.005
24JUL83	800	10	16.5	0.016	.	.	.	.	.	0.006	.	.	0.018
24JUL83	900	53	8.6	0.004	0.001	0.001	.	0.11	0.003	0.001	.	0.005	.
24JUL83	1000	.	4.5	0.003	0.001	0.003	0.004	0.006	0.001	0.001	0.001	0.001	0.001
24JUL83	1100	189	4.5	0.001	0.029	0.001	0.004	0.007	0.001	0.001	0.001	0.001	0.001
24JUL83	1200	265	4.2	0.015	0.046	0.005	0.006	0.02	0.006	0.005	0.001	0.014	0.005
24JUL83	1300	271	4.1	0.008	0.019	0.016	0.011	0.025	0.051	0.041	0.001	0.016	0.001
24JUL83	1400	269	5.6	0.001	0.001	0.006	0.009	0.022	0.028	0.016	0.01	0.001	0.001
24JUL83	1500	262	5.4	0.001	0.001	0.001	0.001	0.001	0.011	0.003	0.013	0.001	0.001
24JUL83	1600	276	6.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.025	0.001	0.001
24JUL83	1700	326	7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001
24JUL83	1800	13	7.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	1900	27	8.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	2000	37	8.2	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	2100	34	9.8	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	2200	37	8.4	0.001	0.001	0.001	0.001	0.012	0.001	0.001	0.001	0.001	0.001
24JUL83	2300	341	8.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24JUL83	2400	320	6.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
25JUL83	100	227	13.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	200	133	7.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	300	55	6.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	400	354	10.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	500	323	9.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	600	345	6	.	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001
25JUL83	700	318	4.8	.	.	0.001	0.001	.	.	.	0.001	0.001	0.001
25JUL83	800	342	5.6	0.001	.	.	.	.	.	0.001	.	.	0.001
25JUL83	900	332	6.9	0.001	0.001	0.001	.	0.001	0.001	0.001	.	0.001	.
25JUL83	1000	20	6.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	1100	316	4.1	0.001	0.004	0.001	0.001	0.001	0.006	0.001	0.001	0.008	0.001
25JUL83	1200	314	5.9	0.001	0.001	0.001	0.001	0.001	0.037	0.001	0.001	0.001	0.001
25JUL83	1300	304	6.5	0.001	0.001	0.001	0.007	0.004	0.001	0.001	0.001	0.001	0.001
25JUL83	1400	26	8.6	0.001	0.001	0.004	0.031	0.057	0.001	0.001	0.001	0.001	0.001
25JUL83	1500	324	9.5	0.001	0.001	0.001	0.044	0.029	0.001	0.001	.	0.001	0.001
25JUL83	1600	327	10.1	0.005	0.004	0.004	0.004	0.001	0.001	0.001	.	0.003	0.005
25JUL83	1700	306	8.7	0.003	0.007	0.003	0.012	0.007	0.007	0.009	.	0.003	0.008
25JUL83	1800	338	7.4	0.007	0.006	0.006	0.007	0.003	.	0.011	0.004	0.011	0.006
25JUL83	1900	333	7.9	0.004	0.004	0.006	.	.	0.008	0.006	0.003	0.006	0.004
25JUL83	2000	332	7.5	0.001	0.001	.	.	0.001	0.001	0.001	0.001	0.005	0.001
25JUL83	2100	329	7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	2200	338	9.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	2300	352	8.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25JUL83	2400	357	10.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	100	41	9.4	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	200	82	7	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	300	80	6.8	0.001	0.003	0.001	0.01	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	400	69	7.7	0.001	0.005	0.001	0.01	0.005	0.001	0.001	0.001	0.003	0.001
26JUL83	500	62	7.4	0.001	0.006	0.001	0.01	0.001	0.001	0.001	0.001	0.004	0.001
26JUL83	600	67	8.2	.	0.003	0.001	0.039	0.001	0.001	.	0.001	0.005	0.001
26JUL83	700	61	7.9	.	.	0.001	0.009	.	.	.	.	0.004	0.001
26JUL83	800	51	6.5	0.004	.	.	.	.	.	.	.	.	0.001
26JUL83	900	69	6.2	0.021	0.02	0.016	0.005	0.006	0.006	0.013	0.001	.	.
26JUL83	1000	80	8	0.023	.	0.027	0.021	0.017	0.019	0.02	0.011	0.031	0.014
26JUL83	1100	89	8	0.015	.	0.026	0.021	0.017	0.012	0.015	0.01	0.016	0.018
26JUL83	1200	79	8.1	0.011	.	0.022	0.014	0.014	0.023	0.013	0.01	0.012	0.012
26JUL83	1300	87	8.3	.	.	0.048	0.011	0.014	0.013	0.009	0.004	0.007	0.005
26JUL83	1400	111	9.9	.	0.089	0.015	0.004	0.003	0.004	0.003	0.001	0.001	0.001
26JUL83	1500	77	6.6	.	0.084	0.115	0.003	0.001	0.001	0.003	0.001	0.006	0.027
26JUL83	1600	73	6.7	.	0.133	0.041	0.005	0.001	0.001	0.009	0.007	0.018	0.022
26JUL83	1700	34	4.9	0.009	0.05	0.063	0.016	0.009	0.009	0.015	0.015	0.011	.
26JUL83	1800	51	5.8	0.001	0.005	0.003	0.003	0.01	0.012	0.005	0.004	0.001	0.001
26JUL83	1900	65	5.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	2000	57	5.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	2100	41	6.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	2200	57	8.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	2300	81	8.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26JUL83	2400	106	11.7	0.001	0.001	0.001	0.004	0.001	0.004	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
27JUL83	100	108	13.5	0.003	0.008	0.007	0.008	0.004	0.008	0.003	0.001	0.007	0.005
27JUL83	200	104	12.5	0.005	0.014	0.009	0.01	0.007	0.011	0.005	0.003	0.007	0.007
27JUL83	300	103	13.1	0.004	0.011	0.008	0.01	0.006	0.012	0.007	0.001	0.006	0.008
27JUL83	400	97	9.8	0.007	0.012	0.009	0.013	0.005	0.012	0.000	0.001	0.007	0.009
27JUL83	500	92	6.3	0.005	0.012	0.008	0.013	0.006	0.009	0.006	0.001	0.009	0.009
27JUL83	600	105	6.4	.	0.01	0.008	0.013	0.005	0.012	.	0.001	0.01	0.007
27JUL83	700	120	9.3	.	0.011	0.006	0.012	.	.	.	.	0.012	0.006
27JUL83	800	90	8.2	0.006	.	.	.	.	.	0.01	.	.	0.007
27JUL83	900	140	10.3	0.007	0.007	0.008	0.007	0.005	.	0.008	0.008	0.009	.
27JUL83	1000	151	8.9	0.01	0.006	0.006	0.006	0.005	.	0.004	0.015	0.004	0.007
27JUL83	1100	161	7	0.001	0.005	0.004	0.004	0.003	.	0.003	0.009	0.001	0.007
27JUL83	1200	154	8.3	0.001	0.005	0.004	0.004	0.001	.	0.003	0.009	0.003	0.007
27JUL83	1300	142	8.8	0.001	0.004	0.004	0.003	0.001	.	0.005	0.024	0.006	0.017
27JUL83	1400	146	7.1	0.007	0.003	0.011	0.012	0.004	.	0.014	0.003	0.013	0.009
27JUL83	1500	159	8.8	0.05	0.019	0.025	0.023	0.022	.	0.016	0.005	0.007	0.004
27JUL83	1600	158	9.1	0.036	0.024	0.031	0.03	0.025	.	0.021	0.013	0.019	0.015
27JUL83	1700	168	9.1	0.116	0.013	0.022	0.017	0.008	.	0.02	0.017	0.024	0.024
27JUL83	1800	184	9.7	0.006	0.003	0.004	0.003	0.001	.	0.001	0.004	0.007	0.012
27JUL83	1900	181	8.3	0.001	0.003	0.003	0.004	0.004	.	0.001	0.001	0.001	0.001
27JUL83	2000	163	6.8	0.003	0.005	0.007	0.008	0.008	.	0.007	0.003	0.003	0.001
27JUL83	2100	156	7.2	0.001	0.006	0.01	0.009	0.005	.	0.003	0.001	0.004	0.001
27JUL83	2200	158	7	0.001	0.009	0.005	0.009	0.003	.	0.003	0.001	0.003	0.001
27JUL83	2300	150	9.6	0.001	0.008	0.004	0.008	0.004	.	0.003	0.001	0.001	0.001
27JUL83	2400	156	10.4	0.001	0.007	0.006	0.008	0.003	.	0.004	0.001	0.001	0.001
28JUL83	100	152	9.9	0.001	0.008	0.005	0.009	0.004	.	0.004	0.001	0.003	0.001
28JUL83	200	151	9	0.001	0.009	0.008	0.012	0.004	.	0.004	0.001	0.007	0.003
28JUL83	300	153	8.9	0.001	0.011	0.007	0.01	0.003	.	0.004	0.001	0.007	0.001
28JUL83	400	155	9.3	0.007	0.01	0.006	0.011	0.004	.	0.003	0.001	0.005	0.001
28JUL83	500	172	9.2	0.046	0.008	0.004	0.01	0.004	.	0.004	0.001	0.006	0.001
28JUL83	600	177	11.4	.	0.004	0.001	0.006	0.004	.	.	0.001	0.005	0.001
28JUL83	700	183	13.4	.	0.001	0.001	0.003	.	.	.	.	0.003	0.001
28JUL83	800	189	15	0.001	.	.	.	0.008	.	0.001	.	.	0.001
28JUL83	900	190	13.2	0.001	0.003	0.001	0.001	0.003	.	0.001	0.001	0.001	.
28JUL83	1000	106	11.7	0.001	0.003	0.001	0.004	0.003	.	0.001	0.001	0.001	0.001
28JUL83	1100	185	12.6	0.001	0.001	0.001	0.003	0.003	.	0.001	0.001	0.001	0.001
28JUL83	1200	189	14.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	1300	189	15.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	1400	197	14.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	1500	191	14.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	1600	189	13.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.025	0.001
28JUL83	1700	102	13.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	1800	177	13.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	1900	170	12.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	2000	163	13.7	0.001	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001
28JUL83	2100	153	12.7	0.001	0.004	0.005	0.001	0.004	.	0.001	0.001	0.005	0.001
28JUL83	2200	148	11.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	2300	153	12.2	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28JUL83	2400	152	15.2	0.015	0.001	0.004	0.001	0.003	.	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

JUNE 1 TO JULY 30, 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
29JUL83	100	171	16.5	0.043	0.005	0.006	0.004	0.007	.	0.001	0.001	0.006	0.001
29JUL83	200	189	13.3	0.003	0.001	0.001	0.003	0.001	.	0.001	0.001	0.003	0.001
29JUL83	300	188	12.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	400	194	12.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	500	187	11.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	600	184	11.1	.	0.001	0.001	0.001	0.001	.	.	0.001	0.001	0.001
29JUL83	700	173	10.1	.	0.001	0.001	0.001	.	.	.	.	0.001	0.001
29JUL83	800	185	13.6	0.001	.	.	.	0.001	.	0.001	.	.	0.001
29JUL83	900	208	12.2	0.001	0.001	0.001	0.001	0.003	.	0.001	0.001	0.135	.
29JUL83	1000	216	12.8	0.001	0.001	0.001	0.001	0.003	.	0.001	0.001	0.065	0.062
29JUL83	1100	202	11.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.033	0.094
29JUL83	1200	198	12.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.028	0.005
29JUL83	1300	200	13	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.004	0.005
29JUL83	1400	197	12.7	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	1500	191	14.2	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	1600	183	14.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	1700	184	16	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	1800	184	16.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	1900	188	14.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	2000	179	12	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	2100	175	10	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	2200	171	8.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	2300	162	9.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
29JUL83	2400	167	10.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.003	0.001
30JUL83	100	156	10.6	0.012	0.001	0.001	0.001	0.001	.	0.001	0.001	0.005	0.001
30JUL83	200	158	9.8	0.004	0.001	0.001	0.001	0.001	.	0.001	0.001	0.006	0.001
30JUL83	300	196	7.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.018	0.006
30JUL83	400	215	7.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.006	0.012
30JUL83	500	195	7.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	600	194	7.9	.	0.001	0.001	0.001	.	.	.	0.001	0.001	0.001
30JUL83	700	192	7.6	.	0.001	0.001	0.001	.	.	.	.	0.001	0.001
30JUL83	800	195	7.5	0.001	.	.	.	0.001	.	0.001	.	.	0.001
30JUL83	900	212	9.7	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.004	.
30JUL83	1000	235	9.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	1100	239	8.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	1200	232	11.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.003	0.006
30JUL83	1300	227	12.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	1400	211	12.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.015	0.023
30JUL83	1500	211	13.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.163	0.031
30JUL83	1600	215	13.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.104	0.04
30JUL83	1700	240	13.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.021	0.026
30JUL83	1800	26	5.1	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	1900	79	4.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	2000	202	9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	2100	185	9.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	2200	183	11.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	2300	130	13.1	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
30JUL83	2400	179	15.2	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.004

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
01AUG83	100	208	12.9	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.003	0.001
01AUG83	200	230	15	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
01AUG83	300	246	13.2	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
01AUG83	400	282	11.2	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
01AUG83	500	307	8.1	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.002
01AUG83	600	311	6.4	.	0.001	0.001	0.003	.	.	.	0.001	0.001	0.001
01AUG83	700	327	7.9	.	0.001	0.001	0.003	.	.	.	.	0.001	0.001
01AUG83	800	324	6.9	0.001	.	.	.	0.001	.	0.001	.	.	0.001
01AUG83	900	322	5.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.009	.
01AUG83	1000	300	4.5	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.009	0.001
01AUG83	1100	318	9.3	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
01AUG83	1200	317	11.5	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
01AUG83	1300	324	12.3	0.001	0.001	0.001	0.003	0.001	.	0.007	0.001	0.001	0.001
01AUG83	1400	324	11.8	0.001	0.001	0.001	0.001	0.001	.	0.033	0.001	0.001	0.001
01AUG83	1500	330	12.1	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	1600	340	11.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	1700	344	11.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	1800	348	12.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	1900	355	12.2	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	2000	6	10.2	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	2100	358	9.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	2200	2	8.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	2300	18	7.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
01AUG83	2400	26	8.2	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
02AUG83	100	25	10.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
02AUG83	200	50	4.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
02AUG83	300	45	2.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
02AUG83	400	57	3.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
02AUG83	500	39	7.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
02AUG83	600	33	6.7	.	0.001	0.001	0.001	.	.	.	0.001	0.001	0.001
02AUG83	700	30	6.7	.	0.001	0.001	0.001	.	.	.	.	0.001	0.001
02AUG83	800	60	4.9	0.004	.	.	.	0.001	.	0.001	.	.	0.001
02AUG83	900	88	3.8	0.008	0.006	0.001	0.003	0.003	.	0.001	.	0.001	.
02AUG83	1000	79	3.5	.	0.003	.	.	.	.	0.001	0.001	.	0.001
02AUG83	1100	23	2.8	0.003	0.012	0.005	0.003	0.003	.	0.001	0.001	0.001	.
02AUG83	1200	291	4.5	0.001	0.07	0.041	0.015	0.089	.	.	0.001	0.001	0.001
02AUG83	1300	.	4.8	0.001	0.001	0.059	0.031	0.059	.	0.001	0.001	0.001	0.001
02AUG83	1400	.	6.6	0.001	0.01	0.004	0.013	0.052	.	0.001	0.001	0.001	0.001
02AUG83	1500	61	6.5	0.014	0.085	0.064	0.000	0.001	.	0.003	0.005	0.013	0.03
02AUG83	1600	66	7	0.052	0.003	0.092	0.015	0.012	.	0.024	0.016	0.046	0.053
02AUG83	1700	62	7.1	0.026	0.069	0.020	0.013	0.011	.	0.011	0.001	0.013	0.02
02AUG83	1800	59	5.7	0.012	0.016	0.044	0.003	0.001	.	0.001	0.001	0.001	0.006
02AUG83	1900	64	7.6	0.006	0.008	0.006	0.004	0.001	.	0.001	0.001	0.003	0.011
02AUG83	2000	67	8.3	0.017	0.017	0.01	0.015	0.005	.	0.009	0.006	0.011	0.023
02AUG83	2100	68	10	0.022	0.024	0.016	0.033	0.026	.	0.023	0.009	0.023	0.025
02AUG83	2200	72	10.2	0.011	0.033	0.01	0.012	0.012	.	0.016	0.009	0.009	0.01
02AUG83	2300	88	8	0.006	0.012	0.005	0.005	0.006	.	0.007	0.005	0.001	0.005
02AUG83	2400	91	9.4	0.001	0.003	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
03AUG83	100	92	6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
03AUG83	200	87	6.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
03AUG83	300	92	7.9	0.001	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
03AUG83	400	100	6.8	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
03AUG83	500	97	6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
03AUG83	600	93	4.7	.	0.001	0.001	0.001	.	.	.	0.001	0.001	0.001
03AUG83	700	97	5.7	.	0.001	0.001	0.001	.	.	.	.	0.003	0.001
03AUG83	800	100	5.6	0.001	.	.	.	0.001	.	0.001	.	.	0.001
03AUG83	900	105	4.6	0.01	0.013	0.012	0.009	0.012	.	0.005	0.003	0.007	.
03AUG83	1000	170	4.8	0.029	0.013	0.021	0.022	0.013	.	0.019	0.009	0.019	0.018
03AUG83	1100	197	3.9	0.012	0.006	0.01	0.01	0.004	.	0.011	0.005	0.027	0.09
03AUG83	1200	209	8.2	0.005	0.006	0.009	0.01	0.005	.	0.008	0.004	0.027	0.19
03AUG83	1300	238	8.6	0.004	0.004	0.009	0.008	0.005	.	0.008	0.005	0.021	0.101
03AUG83	1400	250	8.7	0.003	0.003	0.007	0.006	0.003	.	.	0.004	0.024	0.051
03AUG83	1500	255	6.5	0.003	0.003	0.007	0.006	0.003	.	0.006	0.003	0.073	0.095
03AUG83	1600	260	5	0.001	0.003	0.006	0.006	0.001	.	0.006	0.003	0.055	0.105
03AUG83	1700	274	6.4	0.001	0.001	0.005	0.005	0.001	.	0.005	0.003	0.007	0.06
03AUG83	1800	269	5.7	0.001	0.001	0.005	0.004	0.001	.	0.005	0.003	0.003	0.007
03AUG83	1900	262	4.4	0.001	0.001	0.001	0.001	0.001	.	0.003	0.018	0.001	0.003
03AUG83	2000	211	4.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
03AUG83	2100	144	4.4	0.001	0.001	0.001	0.003	0.001	.	0.004	0.003	0.001	0.001
03AUG83	2200	173	9	0.001	0.001	0.001	0.003	0.001	.	0.003	0.001	0.004	0.005
03AUG83	2300	177	12	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
03AUG83	2400	190	12	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
04AUG83	100	200	11.6	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
04AUG83	200	206	13.1	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.004	0.001
04AUG83	300	213	12.9	0.001	0.001	0.001	0.004	0.001	.	0.003	0.001	0.007	0.001
04AUG83	400	218	11.4	0.001	0.001	0.001	0.004	0.001	.	0.003	0.001	0.005	0.001
04AUG83	500	227	11.5	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
04AUG83	600	224	10.8	.	0.001	0.001	0.003	.	.	.	0.001	0.004	0.001
04AUG83	700	238	9.7	.	0.001	0.001	0.003	.	.	.	.	.	0.001
04AUG83	800	251	10.6	0.001	.	.	.	0.001	.	0.001	.	.	0.003
04AUG83	900	256	14.9	0.001	0.001	0.001	0.005	0.001	.	0.005	0.001	0.004	.
04AUG83	1000	271	14.7	0.001	0.004	0.004	0.009	0.007	.	0.005	0.003	0.005	0.004
04AUG83	1100	263	12.1	0.05	0.069	0.006	0.009	0.004	.	0.005	0.003	0.005	0.003
04AUG83	1200	266	13.7	0.022	0.024	0.004	0.007	0.003	.	0.004	0.001	0.004	0.001
04AUG83	1300	268	12.3	0.001	0.001	0.004	0.006	0.001	.	0.004	0.001	0.001	0.001
04AUG83	1400	268	11.7	0.001	0.001	0.001	0.003	0.001	.	0.018	0.001	0.001	0.001
04AUG83	1500	356	13.1	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
04AUG83	1600	346	11.9	0.001	0.01	0.001	0.019	0.004	.	0.001	0.001	0.001	0.001
04AUG83	1700	31	6.5	0.001	0.001	0.001	0.014	0.001	.	0.001	0.001	0.001	0.001
04AUG83	1800	313	10.5	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
04AUG83	1900	.	2.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.003	0.001
04AUG83	2000	83	3.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
04AUG83	2100	126	2.8	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
04AUG83	2200	162	2.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
04AUG83	2300	168	5.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
04AUG83	2400	176	5.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TONER	SR 65	E. MT. CARMEL	OLD INDIAN
05AUG83	100	186	5.7	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	200	188	5.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	300	203	6.3	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	400	202	5.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	500	192	6.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	600	204	6.2	0.001	0.001	0.001	0.001	.	.	.	0.001	0.001	0.001
05AUG83	700	237	5.5	.	0.001	0.001	0.001	.	.	.	.	0.003	0.001
05AUG83	800	32	5.3	0.001	.	.	.	0.001	.	0.003	.	.	0.001
05AUG83	900	.	2.6	0.003	0.001	0.001	0.003	0.001	.	0.006	0.001	0.005	.
05AUG83	1000	209	5.2	0.001	0.001	0.001	0.003	0.001	.	0.004	0.001	0.009	0.001
05AUG83	1100	290	10	0.001	0.001	0.007	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	1200	274	4	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
05AUG83	1300	243	6.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	1400	247	7.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	1500	270	9.8	0.001	0.001	0.003	0.003	0.001	.	0.001	0.001	0.003	0.001
05AUG83	1600	265	10.5	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
05AUG83	1700	265	13.3	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
05AUG83	1800	266	10.6	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.006
05AUG83	1900	312	4.8	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
05AUG83	2000	299	8.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	2100	306	6.7	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	2200	260	7.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	2300	286	9.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
05AUG83	2400	302	11.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	100	317	10	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	200	319	8.6	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	300	294	6.9	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	400	295	6.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	500	314	5.5	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	600	272	6.2	0.001	0.001	0.001	0.001	.	.	.	0.001	0.001	0.001
06AUG83	700	285	7.1	.	0.001	0.001	0.001	.	.	.	.	0.001	0.001
06AUG83	800	324	6.3	0.001	.	.	.	0.001	.	0.001	.	.	0.001
06AUG83	900	15	4.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.004	.
06AUG83	1000	353	3.7	0.001	0.001	0.001	0.007	0.001	.	0.001	0.001	0.003	0.001
06AUG83	1100	301	4.8	0.001	0.001	0.001	0.006	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1200	343	8	0.001	0.001	0.001	0.005	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1300	321	5.7	0.001	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1400	332	6.2	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1500	332	7.3	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1600	324	8	0.001	0.001	0.001	0.011	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1700	328	10.3	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1800	319	10.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	1900	321	9.4	0.001	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
06AUG83	2000	204	11.3	0.001	0.001	0.001	0.005	0.001	.	0.003	0.001	0.006	0.001
06AUG83	2100	347	11.2	0.004	0.001	0.003	0.007	0.001	.	0.004	0.001	0.005	0.001
06AUG83	2200	18	9.2	0.004	0.001	0.001	0.007	0.001	.	0.001	0.001	0.007	0.001
06AUG83	2300	18	10.3	0.001	0.001	0.001	0.006	0.001	.	0.001	0.001	0.005	0.001
06AUG83	2400	24	9.3	0.001	0.001	0.001	0.005	0.001	.	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
07AUG83	100	23	8.2	0.001	0.003	0.001	0.005	0.001	.	0.001	0.001	0.001	0.001
07AUG83	200	15	9.2	0.001	0.001	0.001	0.005	0.001	.	0.001	0.001	0.001	0.001
07AUG83	300	8	8.7	0.001	0.001	0.001	0.006	0.001	.	0.001	0.001	0.004	0.001
07AUG83	400	351	9.4	0.008	0.008	0.001	0.01	0.001	.	0.001	0.001	0.009	0.003
07AUG83	500	10	8.3	0.007	0.004	0.001	0.012	0.001	.	0.001	0.001	0.013	0.004
07AUG83	600	14	9.5	0.004	0.001	0.001	0.009	.	.	.	0.001	0.006	0.001
07AUG83	700	26	7.6	.	0.001	0.001	0.009	.	.	.	.	0.003	0.001
07AUG83	800	16	7	0.001	.	.	.	0.001	.	0.001	.	.	0.001
07AUG83	900	356	4.3	0.001	0.001	0.001	0.007	0.007	.	0.001	0.001	0.001	.
07AUG83	1000	322	4.5	0.001	0.001	0.001	0.011	0.037	.	0.001	0.001	0.001	0.001
07AUG83	1100	.	4.6	0.001	0.001	0.003	0.009	0.087	.	0.001	0.001	0.001	0.001
07AUG83	1200	323	7.1	0.001	0.001	0.001	0.007	0.001	.	0.001	0.001	0.001	0.001
07AUG83	1300	313	5.5	0.001	0.001	0.001	0.004	0.029	.	0.001	0.001	0.001	0.001
07AUG83	1400	313	6	0.001	0.021	0.02	0.055	0.125	.	0.001	0.001	0.001	0.001
07AUG83	1500	295	5.8	0.001	0.038	0.116	0.265	0.071	.	0.011	0.001	0.001	0.001
07AUG83	1600	309	6.1	0.001	0.003	0.015	0.068	0.055	.	0.001	0.001	0.001	0.001
07AUG83	1700	332	7.1	0.001	0.001	0.001	0.004	0.013	.	0.001	0.001	0.001	0.001
07AUG83	1800	331	8.5	0.001	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
07AUG83	1900	7	7.1	0.001	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
07AUG83	2000	351	6.2	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
07AUG83	2100	46	5.5	0.001	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
07AUG83	2200	49	6.1	0.001	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
07AUG83	2300	35	11.6	0.001	0.001	0.001	0.007	0.001	.	0.001	0.001	0.001	0.001
07AUG83	2400	35	10.8	0.001	0.001	0.001	0.007	0.003	.	0.001	0.001	0.001	0.001
08AUG83	100	37	10.2	0.001	0.001	0.001	0.006	0.001	.	0.001	0.001	0.001	0.001
08AUG83	200	40	9.4	0.001	0.001	0.001	0.005	0.001	.	0.001	0.001	0.001	0.001
08AUG83	300	60	8.7	0.001	0.001	0.001	0.005	0.001	.	0.001	0.001	0.001	0.001
08AUG83	400	37	9.5	0.001	0.001	0.001	0.006	0.001	.	0.001	0.001	0.001	0.001
08AUG83	500	35	9.6	0.001	0.001	0.001	0.008	0.001	.	0.001	0.001	0.001	0.001
08AUG83	600	29	8.9	0.001	0.001	0.001	0.009	.	.	.	0.001	0.001	0.001
08AUG83	700	30	9.3	.	0.001	0.001	0.009	.	.	.	.	0.001	0.001
08AUG83	800	39	6	0.001	.	.	.	0.005	.	0.001	.	.	0.001
08AUG83	900	48	5.1	0.008	0.003	0.016	0.009	0.005	.	0.001	0.001	0.003	.
08AUG83	1000	.	2.1	0.041	0.025	0.012	0.016	0.009	.	0.009	0.006	0.014	0.012
08AUG83	1100	275	2.7	0.026	0.047	0.018	0.042	0.027	.	0.015	0.01	0.017	0.013
08AUG83	1200	222	3.5	0.026	0.015	0.049	0.046	0.067	.	0.016	0.016	0.013	0.012
08AUG83	1300	239	4	0.006	0.01	0.039	0.148	0.059	.	0.014	.	0.006	0.007
08AUG83	1400	225	4.2	0.004	0.003	0.025	0.076	0.094	.	0.154	0.046	0.01	0.005
08AUG83	1500	242	3.3	0.001	0.003	0.006	0.020	.	.	0.109	0.101	0.013	0.004
08AUG83	1600	.	4.4	0.001	0.001	0.001	0.008	.	0.087	0.025	0.017	0.003	0.001
08AUG83	1700	322	8	0.001	0.001	0.001	0.005	.	0.026	0.001	0.003	0.001	0.001
08AUG83	1800	346	6.5	0.001	0.001	0.001	.	.	0.001	0.001	0.001	0.001	0.001
08AUG83	1900	50	6.6	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001	0.001
08AUG83	2000	12	7.1	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
08AUG83	2100	351	9	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
08AUG83	2200	356	12.1	0.001	0.001	0.001	0.005	0.001	0.001	0.01	0.001	0.001	0.001
08AUG83	2300	349	10.8	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
08AUG83	2400	9	8.9	0.001	0.001	0.001	0.005	0.001	0.003	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMBIER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
09AUG83	100	17	1.9	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
09AUG83	200	290	2.4	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
09AUG83	300	304	2.7	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
09AUG83	400	324	3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
09AUG83	500	321	3.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
09AUG83	600	258	2.5	0.001	0.001	.	0.003	.	0.001	.	0.001	0.001	0.001
09AUG83	700	290	4.0	.	0.001	.	0.003	.	.	.	.	0.001	0.001
09AUG83	800	320	6.4	0.001	.	.	.	0.001	.	0.001	.	.	0.001
09AUG83	900	319	5.3	0.001	0.001	.	0.005	0.001	0.001	0.001	0.001	0.004	.
09AUG83	1000	292	7.2	0.001	0.001	.	0.006	0.001	0.001	0.001	0.001	0.004	0.001
09AUG83	1100	267	7.1	0.001	0.001	.	0.006	0.001	0.001	0.001	0.001	0.003	0.001
09AUG83	1200	290	7.9	.	0.013	0.001	0.01	0.013	0.003	0.006	0.012	0.003	0.001
09AUG83	1300	311	8.2	0.014	.	0.005	0.017	0.005	0.006	0.010	0.004	0.011	0.001
09AUG83	1400	333	9.5	0.001	0.003	0.001	0.007	0.003	0.003	.	0.003	0.006	0.001
09AUG83	1500	334	0.0	0.001	0.001	0.001	0.004	0.001	0.001	0.01	0.001	.	0.001
09AUG83	1600	343	8.9	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	.	0.001
09AUG83	1700	347	11.7	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	.	0.001
09AUG83	1800	323	13.2	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.003	0.004
09AUG83	1900	13	15.7	0.005	0.000	0.003	0.013	0.006	0.005	0.005	0.001	0.005	0.005
09AUG83	2000	14	14.7	0.001	0.003	0.001	0.007	0.001	0.001	0.003	0.001	0.003	0.003
09AUG83	2100	22	13.5	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
09AUG83	2200	34	11.7	0.001	0.001	0.001	0.023	0.012	0.001	0.001	0.001	0.001	0.001
09AUG83	2300	44	11.1	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
09AUG83	2400	39	10.1	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10AUG83	100	41	10.1	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10AUG83	200	39	10.7	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10AUG83	300	33	11	0.001	0.001	0.001	0.004	0.007	0.001	0.001	0.001	0.001	0.003
10AUG83	400	36	10	0.001	0.001	0.001	0.007	0.01	0.001	0.001	0.001	0.001	0.003
10AUG83	500	26	12.5	0.001	0.001	0.001	0.009	0.004	0.001	0.001	0.001	0.001	0.003
10AUG83	600	36	11.2	0.001	0.001	0.001	0.005	.	0.001	.	0.001	0.001	0.004
10AUG83	700	43	9.6	.	0.001	.	0.003	0.001	.	.	.	.	0.005
10AUG83	800	46	7.2	0.003	.	0.004	.	0.008	.	0.001	.	.	.
10AUG83	900	75	4.4	0.022	0.019	0.006	0.006	0.007	0.003	0.005	0.003	0.004	.
10AUG83	1000	103	3.5	0.008	0.000	0.005	0.000	0.007	0.006	0.005	0.003	0.006	.
10AUG83	1100	.	2.6	0.008	0.050	0.007	0.01	0.014	0.007	0.006	0.004	0.006	.
10AUG83	1200	179	3.9	0.02	0.032	0.051	0.000	0.055	0.017	0.005	0.001	0.003	0.005
10AUG83	1300	227	3.9	0.023	0.009	0.038	0.04	0.024	0.012	0.180	0.094	0.042	0.005
10AUG83	1400	265	3.2	0.009	0.000	0.012	0.024	0.011	0.01	0.027	0.051	0.102	0.024
10AUG83	1500	235	3.6	0.006	0.012	0.01	0.014	0.013	0.011	0.012	0.008	0.029	0.019
10AUG83	1600	220	7.4	0.007	0.005	0.000	0.01	0.005	0.004	0.007	0.004	0.013	0.025
10AUG83	1700	244	9.6	0.001	0.003	0.001	0.007	0.003	0.001	0.001	0.001	0.001	0.012
10AUG83	1800	214	11.3	0.001	0.003	0.003	0.007	0.003	0.001	0.001	0.001	0.019	0.011
10AUG83	1900	202	14.0	0.001	0.001	0.003	0.006	0.003	0.001	0.001	0.001	0.004	0.009
10AUG83	2000	191	14.9	0.001	0.003	0.003	0.007	0.003	0.003	0.001	0.001	0.001	0.001
10AUG83	2100	193	15.6	0.001	0.001	0.001	0.006	0.003	0.001	0.001	0.001	0.001	0.001
10AUG83	2200	203	14.7	0.001	0.004	0.004	0.000	0.006	0.004	0.001	0.001	0.03	0.000
10AUG83	2300	207	13	0.006	0.009	0.007	0.013	0.009	0.006	0.005	0.001	0.05	0.039
10AUG83	2400	211	13.0	0.004	0.005	0.004	0.011	0.005	0.004	0.003	0.001	0.11	0.186

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
11AUG83	100	212	17.9	0.001	0.001	0.001	0.007	0.001	0.003	0.001	0.001	0.103	0.174
11AUG83	200	218	16.9	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.036	0.053
11AUG83	300	222	18.1	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	400	227	18.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	500	229	17.6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	600	232	18.9	0.001	0.001	0.001	0.004	.	0.001	.	0.001	0.001	0.001
11AUG83	700	242	17	.	0.001	.	0.003	0.001	.	.	.	.	0.001
11AUG83	800	243	17.1	0.001	.	0.001	.	0.001	.	0.001	.	.	0.006
11AUG83	900	257	17.4	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.011
11AUG83	1000	281	16.9	0.004	0.004	0.003	0.008	0.005	0.004	0.001	0.026	0.005	.
11AUG83	1100	309	11.8	0.004	0.004	0.004	0.009	0.006	0.006	0.004	0.005	0.005	.
11AUG83	1200	326	13.2	0.001	0.001	0.003	0.007	0.004	0.004	0.001	0.001	0.001	0.001
11AUG83	1300	325	15.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	1400	336	18.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
11AUG83	1500	338	20	0.001	0.001	0.001	0.001	0.001	0.029	0.001	0.001	0.005	0.001
11AUG83	1600	338	17.2	0.001	0.001	0.001	0.001	0.001	0.007	0.001	0.001	0.007	0.001
11AUG83	1700	341	20.6	0.001	0.001	0.001	0.001	0.001	0.034	0.001	0.001	0.008	0.001
11AUG83	1800	341	20.3	0.001	0.001	0.001	0.001	0.001	0.107	0.001	0.001	0.001	0.001
11AUG83	1900	312	18.1	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
11AUG83	2000	349	18.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	2100	326	14	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	2200	344	13.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	2300	357	12.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11AUG83	2400	359	12.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12AUG83	100	341	12.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12AUG83	200	313	9.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12AUG83	300	295	7.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12AUG83	400	344	7.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12AUG83	500	338	6.6	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001
12AUG83	600	336	8.5	0.001	0.001	0.001	0.001	.	0.001	.	0.001	0.004	0.004
12AUG83	700	2	9.9	.	0.001	.	0.001	0.001	.	.	.	.	0.008
12AUG83	800	26	8.6	0.005	.	0.001	.	0.006	.	0.004	.	.	0.006
12AUG83	900	22	10	0.001	0.001	0.001	0.004	0.017	0.001	0.001	0.001	0.001	0.001
12AUG83	1000	34	10.7	0.001	0.001	0.001	0.024	0.041	0.001	0.001	0.001	0.001	.
12AUG83	1100	30	9.6	0.001	0.001	0.001	0.005	0.026	0.001	0.001	0.001	0.001	.
12AUG83	1200	28	11.1	0.001	0.001	0.001	0.032	0.027	0.001	0.001	0.001	0.001	0.001
12AUG83	1300	39	8.1	0.001	0.001	0.001	0.02	0.091	0.001	0.001	0.001	0.001	0.001
12AUG83	1400	42	7.6	0.001	0.001	0.001	0.01	0.081	0.001	0.001	0.001	0.001	0.001
12AUG83	1500	27	7.8	0.001	0.001	0.001	0.022	0.061	0.001	0.001	0.001	0.001	0.001
12AUG83	1600	.	4	0.001	0.003	0.018	0.011	0.015	0.001	0.001	0.001	0.001	0.001
12AUG83	1700	.	4.3	0.001	0.02	0.115	0.068	0.029	0.001	0.001	0.001	0.001	0.001
12AUG83	1800	186	3.4	0.001	0.008	0.028	0.023	0.036	0.007	0.001	0.003	0.001	0.001
12AUG83	1900	88	2.2	0.013	0.018	0.036	0.021	0.01	0.006	0.001	0.003	0.001	0.003
12AUG83	2000	93	3	0.018	0.011	0.013	0.03	0.012	0.006	0.001	0.004	0.001	0.001
12AUG83	2100	89	4.2	0.005	0.005	0.001	0.016	0.01	0.009	0.001	0.001	0.003	0.001
12AUG83	2200	80	7.4	0.001	0.004	0.001	0.008	0.005	0.007	0.001	0.001	0.004	0.001
12AUG83	2300	87	7	0.001	0.001	0.001	0.005	0.003	0.001	0.001	0.001	0.003	0.001
12AUG83	2400	90	6.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO_2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
13AUG83	100	46	8.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
13AUG83	200	69	7.1	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
13AUG83	300	62	7.3	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
13AUG83	400	55	10	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
13AUG83	500	46	10.4	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
13AUG83	600	56	9.7	0.001	0.001	0.001	0.004	.	0.001	.	0.001	0.001	0.001
13AUG83	700	59	9.1	.	0.003	.	0.004	0.001	.	.	.	.	0.001
13AUG83	800	72	8.4	0.006	.	0.001	.	0.001	.	0.001	.	.	0.003
13AUG83	900	76	6.3	0.024	0.015	0.004	0.008	0.006	0.008	0.001	0.003	0.006	0.003
13AUG83	1000	84	4.3	0.009	0.015	0.004	0.01	0.01	0.01	0.004	0.005	0.005	.
13AUG83	1100	103	5.9	0.004	0.006	0.003	0.007	0.006	0.006	0.003	0.004	0.004	.
13AUG83	1200	95	5.0	0.007	0.062	0.003	0.007	0.004	0.006	0.004	0.005	0.006	0.008
13AUG83	1300	5	6.1	0.007	0.145	0.113	0.011	0.008	0.01	0.007	0.006	0.006	0.009
13AUG83	1400	.	6.1	0.005	0.123	0.018	0.008	0.007	0.007	0.004	0.004	0.003	0.006
13AUG83	1500	.	5.2	0.01	0.204	0.013	0.007	0.005	0.004	0.005	0.005	0.014	0.028
13AUG83	1600	.	3.0	0.025	0.102	0.02	0.096	0.08	0.01	0.017	0.013	0.022	0.017
13AUG83	1700	.	4.7	0.004	0.021	0.016	0.030	0.252	0.014	0.01	0.01	0.003	0.005
13AUG83	1800	58	8.0	0.005	0.031	0.030	0.011	0.03	0.014	0.006	0.009	0.003	0.007
13AUG83	1900	60	5	0.012	0.008	0.018	0.015	0.011	0.016	0.013	0.014	0.01	0.014
13AUG83	2000	26	6.9	0.008	0.008	0.009	0.015	0.013	0.015	0.007	0.013	0.008	0.012
13AUG83	2100	34	10.4	0.004	0.008	0.003	0.011	0.009	0.012	0.003	0.006	0.004	0.005
13AUG83	2200	53	11.3	0.003	0.007	0.005	0.01	0.011	0.007	0.003	0.004	0.004	0.006
13AUG83	2300	64	12.7	0.004	0.013	0.004	0.016	0.019	0.006	0.005	0.004	0.008	0.006
13AUG83	2400	63	13	0.006	0.027	0.004	0.045	0.029	0.008	0.007	0.003	0.009	0.006
14AUG83	100	72	9.0	0.005	0.027	0.006	0.025	0.025	0.008	0.007	0.001	0.009	0.003
14AUG83	200	90	9.2	0.005	0.024	0.01	0.015	0.012	0.011	0.009	0.003	0.009	0.008
14AUG83	300	89	7.0	0.004	0.014	0.007	0.015	0.01	0.008	0.007	0.001	0.01	0.009
14AUG83	400	80	7.7	0.003	0.013	0.008	0.014	0.009	0.009	0.004	0.003	0.006	0.003
14AUG83	500	96	8.3	0.001	0.01	0.008	0.015	.	0.007	0.004	0.001	0.006	0.007
14AUG83	600	100	7.7	0.001	0.008	0.007	0.013	.	0.004	.	0.001	0.004	0.006
14AUG83	700	105	7.4	.	0.003	.	0.013	0.006	.	.	.	.	0.005
14AUG83	800	113	9.6	0.004	.	0.009	.	0.007	.	0.001	.	.	0.006
14AUG83	900	100	7.2	0.019	0.02	0.013	0.016	0.017	0.022	0.011	0.011	0.017	0.014
14AUG83	1000	122	5.6	0.043	0.02	0.025	0.024	0.017	0.019	0.033	0.077	0.04	.
14AUG83	1100	123	5.6	0.032	0.015	0.019	0.021	0.012	0.022	0.027	0.040	0.036	.
14AUG83	1200	126	5.3	0.035	0.029	0.023	0.026	0.016	0.017	0.024	0.006	0.036	0.039
14AUG83	1300	112	5.0	0.008	0.133	0.007	0.009	0.011	0.008	0.008	0.007	0.005	0.01
14AUG83	1400	153	3.5	0.008	0.100	0.04	0.011	0.013	0.006	0.006	0.003	0.004	0.008
14AUG83	1500	232	4.3	0.008	0.122	0.106	0.037	0.013	0.004	0.01	0.003	0.003	0.007
14AUG83	1600	246	3.9	0.008	0.095	0.160	0.181	0.047	0.039	0.107	0.003	0.001	0.006
14AUG83	1700	242	4.7	0.005	0.03	0.049	0.201	0.167	0.084	0.092	0.003	0.001	0.007
14AUG83	1800	.	4.7	0.005	0.007	0.004	0.007	0.033	0.059	0.006	0.007	0.003	0.009
14AUG83	1900	32	6.1	0.006	0.006	0.003	0.009	0.006	0.012	0.007	0.01	0.004	0.01
14AUG83	2000	52	7.9	0.005	0.006	0.003	0.008	0.007	0.007	0.005	0.007	0.001	0.006
14AUG83	2100	62	10	0.004	0.005	0.003	0.005	0.005	0.006	0.003	0.001	0.001	0.001
14AUG83	2200	65	10.2	0.001	0.005	0.001	0.004	0.003	0.003	0.001	0.001	0.001	0.001
14AUG83	2300	77	6	0.001	0.006	0.004	0.008	0.004	0.001	0.004	0.001	0.001	0.003
14AUG83	2400	89	6.2	0.004	0.014	0.005	0.007	0.004	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
15AUG83	100	89	5.5	0.001	0.013	0.003	0.007	0.003	0.001	0.001	0.001	0.001	0.001
15AUG83	200	45	5.1	0.001	0.004	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
15AUG83	300	53	5.9	0.001	0.006	0.001	0.004	0.004	0.003	0.001	0.001	0.001	0.001
15AUG83	400	78	5.3	0.001	0.006	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
15AUG83	500	84	6.9	0.001	0.005	0.001	0.005	.	0.001	0.001	0.001	0.001	0.001
15AUG83	600	73	6.1	0.001	0.005	0.001	0.005	.	0.001	.	0.001	0.001	0.001
15AUG83	700	77	5	.	0.006	.	0.004	0.001	.	.	.	.	0.001
15AUG83	800	83	4.8	0.014	.	0.003	.	0.001	.	0.001	.	.	0.001
15AUG83	900	86	3	0.027	0.012	0.008	0.011	0.011	0.007	0.007	0.005	0.004	0.008
15AUG83	1000	214	2.2	0.033	0.022	0.021	0.022	0.018	0.018	0.019	0.014	0.022	.
15AUG83	1100	230	3.7	0.048	0.025	0.02	0.027	0.03	0.019	0.028	0.025	0.059	.
15AUG83	1200	238	3.3	0.043	0.036	0.033	0.042	0.035	0.054	0.048	0.052	0.036	0.054
15AUG83	1300	230	4.2	0.04	0.03	0.036	0.038	0.026	0.063	0.078	0.032	0.045	0.037
15AUG83	1400	254	3.8	0.023	0.022	0.022	0.021	0.014	0.047	0.057	0.039	0.053	0.042
15AUG83	1500	251	3.6	0.011	0.019	0.013	0.015	0.02	0.024	0.015	0.039	0.031	0.098
15AUG83	1600	211	2.8	0.016	0.02	0.018	0.017	0.022	0.023	0.014	0.024	0.022	0.044
15AUG83	1700	219	2.8	0.02	0.014	0.019	0.02	0.014	0.026	0.02	0.018	0.049	0.063
15AUG83	1800	134	6.5	0.014	0.009	0.012	0.015	0.009	0.023	0.022	0.016	0.036	0.053
15AUG83	1900	127	8.8	0.02	0.01	0.014	0.015	0.009	0.013	0.019	0.013	0.018	0.024
15AUG83	2000	151	8.3	0.013	0.009	0.007	0.01	0.005	0.007	0.011	0.008	0.012	0.017
15AUG83	2100	163	9	0.006	0.007	0.006	0.008	0.004	0.006	0.007	0.005	0.007	0.009
15AUG83	2200	171	8.8	0.005	0.006	0.005	0.005	0.003	0.005	0.006	0.003	0.006	0.007
15AUG83	2300	176	7.3	0.001	0.005	0.001	0.007	0.003	0.004	0.004	0.001	0.005	0.005
15AUG83	2400	185	7.8	0.001	0.005	0.001	0.007	0.003	0.005	0.003	0.001	0.003	0.003
16AUG83	100	191	7.4	0.001	0.006	0.001	0.007	0.001	0.005	0.001	0.001	0.003	0.001
16AUG83	200	192	6.5	0.001	0.005	0.001	0.037	0.003	0.004	0.001	0.001	0.001	0.001
16AUG83	300	196	6.1	0.001	0.004	0.001	0.006	0.003	0.001	0.001	0.001	0.001	0.113
16AUG83	400	206	5.5	0.001	0.004	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.003
16AUG83	500	207	6.5	0.001	0.001	0.001	0.006	.	0.001	0.001	0.001	0.001	0.001
16AUG83	600	191	5.8	0.001	0.001	0.001	0.005	.	0.001	.	0.001	0.001	0.001
16AUG83	700	218	5.9	.	0.005	.	0.007	0.001	.	.	.	.	0.001
16AUG83	800	194	5.3	0.001	.	0.001	.	0.001	.	0.001	.	.	0.001
16AUG83	900	189	5.5	0.001	0.003	0.003	0.005	0.003	0.003	0.003	0.001	0.003	0.001
16AUG83	1000	211	7.5	0.001	0.001	0.001	.	.	.	0.001	.	0.018	.
16AUG83	1100	211	7.2	.	.	.	0.005	0.001	0.001	0.001	0.001	0.001	.
16AUG83	1200	.	5.9	0.001	0.001	0.001	0.004	0.001	0.001	.	0.001	.	.
16AUG83	1300	228	14.1	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.004	.
16AUG83	1400	211	10.3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.04	.
16AUG83	1500	218	12.1	0.001	0.001	0.001	0.004	0.001	0.001	0.001	.	0.028	0.07
16AUG83	1600	218	11.5	0.001	0.001	0.001	0.003	0.001	0.001	.	0.001	0.015	0.014
16AUG83	1700	211	10.7	0.001	0.001	0.001	0.003	0.001	0.001	.	0.001	0.032	0.073
16AUG83	1800	204	11.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.004	0.019
16AUG83	1900	100	12.7	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
16AUG83	2000	182	12	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
16AUG83	2100	184	13.2	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
16AUG83	2200	180	13.5	0.001	0.005	0.003	0.009	0.001	0.004	0.001	0.001	0.005	0.004
16AUG83	2300	193	12.6	0.001	0.007	0.004	0.009	0.001	0.004	0.001	0.001	0.004	0.004
16AUG83	2400	198	12.7	0.001	0.006	0.001	0.009	0.001	0.006	0.001	0.001	0.005	0.004

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
17AUG83	100	208	11.8	0.001	0.005	0.001	0.008	0.001	0.003	0.001	0.001	0.006	0.001
17AUG83	200	205	12	0.001	0.003	0.001	0.005	0.001	0.001	0.001	0.001	0.005	0.003
17AUG83	300	203	11.5	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.003	0.001
17AUG83	400	199	11.8	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
17AUG83	500	198	12.6	0.001	0.001	0.001	0.005	.	0.001	0.001	0.001	0.001	0.001
17AUG83	600	206	14	0.001	0.001	0.001	0.005	.	0.001	.	0.001	0.030	0.023
17AUG83	700	200	12.2	.	0.001	.	0.004	0.001	.	.	.	0.008	0.099
17AUG83	800	211	13.5	0.001	.	0.001	.	0.001	.	0.001	.	.	0.067
17AUG83	900	212	14.8	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.044	0.039
17AUG83	1000	216	16.8	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.062	.
17AUG83	1100	225	19.5	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	.
17AUG83	1200	222	19.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
17AUG83	1300	219	15.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
17AUG83	1400	.	15.3	0.001	0.024	0.001	0.015	0.005	0.001	0.001	0.001	0.001	0.001
17AUG83	1500	105	19.9	0.001	0.019	0.007	0.005	0.003	0.001	0.001	0.001	0.001	0.001
17AUG83	1600	50	16.5	0.001	0.004	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
17AUG83	1700	140	17	0.01	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
17AUG83	1800	172	14.0	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
17AUG83	1900	187	15.1	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
17AUG83	2000	190	14.0	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.065	0.017
17AUG83	2100	200	15.1	0.001	0.003	0.001	0.005	0.001	0.001	0.001	0.001	0.046	0.075
17AUG83	2200	207	14.8	0.001	0.009	0.004	0.007	0.003	0.001	0.001	0.001	0.007	0.004
17AUG83	2300	207	14	0.007	0.011	0.006	0.009	0.004	0.001	0.001	0.001	0.01	0.009
17AUG83	2400	208	10.8	0.001	0.005	0.003	0.006	0.001	0.003	0.001	0.001	0.004	0.001
18AUG83	100	208	12.9	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	200	196	12.6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	300	195	14.6	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.009	0.007
18AUG83	400	207	14.7	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.005	0.01
18AUG83	500	209	14.1	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001
18AUG83	600	213	13.9	0.001	0.001	0.001	0.003	.	0.001	.	0.001	0.001	0.001
18AUG83	700	204	13.6	.	0.001	.	0.003	0.001	.	.	.	0.028	0.034
18AUG83	800	210	14.7	0.001	.	0.001	.	0.001	.	0.001	.	.	0.023
18AUG83	900	210	16.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.016	0.005
18AUG83	1000	209	16.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.023	.
18AUG83	1100	219	18.4	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	.
18AUG83	1200	225	18.3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	1300	224	19.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	1400	244	16.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	1500	220	17.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	1600	239	14.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	1700	249	12.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	1800	229	12.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	1900	215	13.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	2000	210	12.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	2100	205	10.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	2200	210	13.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	2300	215	11.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18AUG83	2400	220	12	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
19AUG83	100	224	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	200	224	11.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	300	226	11.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	400	230	9.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	500	223	8.1	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
19AUG83	600	224	8.4	0.001	0.001	0.001	0.003	.	0.001	.	0.001	0.001	0.001
19AUG83	700	221	8	.	0.001	.	0.003	0.001	.	.	.	0.003	0.001
19AUG83	800	223	8.9	0.001	.	0.001	.	0.001	.	0.001	.	.	0.001
19AUG83	900	242	8.7	0.001	0.003	0.001	0.001	0.008	0.009	0.001	0.001	0.001	0.005
19AUG83	1000	254	8.7	0.001	0.014	0.01	0.013	0.039	0.036	0.001	0.001	0.004	.
19AUG83	1100	263	8.5	0.001	0.007	0.005	0.009	0.012	0.017	0.004	0.001	0.007	.
19AUG83	1200	260	8.4	0.001	0.003	0.003	0.006	0.006	0.006	0.003	0.001	0.003	0.001
19AUG83	1300	268	8.6	0.001	0.001	0.001	0.004	0.005	0.005	0.001	0.001	0.001	0.001
19AUG83	1400	262	5.9	0.001	0.001	0.003	0.004	0.006	0.006	0.003	0.001	0.001	0.001
19AUG83	1500	233	7.2	0.001	0.006	0.005	0.008	0.009	0.007	0.006	0.001	0.007	0.024
19AUG83	1600	250	7.3	0.001	0.004	0.004	0.005	0.001	0.001	0.004	0.001	0.033	0.019
19AUG83	1700	248	6.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	1800	241	8.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	1900	231	9.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	2000	219	9.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	2100	206	8.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	2200	206	9.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	2300	207	10.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19AUG83	2400	216	11.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	100	244	8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	200	245	8.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	300	255	7.8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	400	259	6.4	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001
20AUG83	500	264	6	0.001	0.001	0.001	0.001	.	0.001	0.007	0.001	0.001	0.001
20AUG83	600	257	6	0.001	0.001	0.001	0.001	.	0.001	.	0.001	0.001	0.001
20AUG83	700	241	5.4	.	0.001	.	0.001	0.001	.	.	.	0.005	0.001
20AUG83	800	225	5.3	0.001	.	0.001	.	0.001	.	0.005	.	.	0.001
20AUG83	900	252	5.4	0.001	0.003	0.001	0.003	0.001	0.001	0.005	0.001	0.001	0.007
20AUG83	1000	253	5.3	0.001	0.003	0.001	0.006	0.003	0.006	0.004	0.001	0.001	.
20AUG83	1100	242	3.9	0.001	0.004	0.004	0.007	0.001	0.004	0.006	0.001	0.003	.
20AUG83	1200	194	3	0.001	0.001	0.003	0.006	0.001	0.001	0.005	0.001	0.001	0.052
20AUG83	1300	194	4.7	0.001	0.001	0.001	0.003	0.001	0.001	0.003	0.001	0.004	0.12
20AUG83	1400	197	6.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.118
20AUG83	1500	210	5.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.104
20AUG83	1600	214	6.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.053
20AUG83	1700	241	5.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	1800	217	4.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
20AUG83	1900	217	6.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	2000	178	9.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	2100	175	10.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20AUG83	2200	188	12.3	0.001	0.001	0.001	0.004	0.001	0.001	0.005	0.001	0.001	0.001
20AUG83	2300	200	11.2	0.001	0.003	0.001	0.005	0.001	0.001	0.005	0.001	0.001	0.001
20AUG83	2400	221	8	0.001	0.001	0.001	0.005	0.001	0.001	0.004	0.001	0.004	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
21AUG83	100	230	6.8	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
21AUG83	200	237	5.5	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
21AUG83	300	229	6.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
21AUG83	400	237	5.9	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
21AUG83	500	237	6	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
21AUG83	600	230	6.6	0.001	0.001	0.001	0.001	.	0.001	.	0.001	0.001	0.001
21AUG83	700	211	6	.	0.001	.	0.001	0.001	.	.	.	0.004	0.001
21AUG83	800	205	6.1	0.001	.	0.001	.	0.001	.	0.001	.	.	0.001
21AUG83	900	219	6.6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21AUG83	1000	235	6.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
21AUG83	1100	228	7.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
21AUG83	1200	235	10.0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
21AUG83	1300	213	13.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.04	0.026
21AUG83	1400	219	14	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.044	0.009
21AUG83	1500	214	13.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.059	0.065
21AUG83	1600	219	12.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.033
21AUG83	1700	221	15	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21AUG83	1800	214	15.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.02
21AUG83	1900	196	15.3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
21AUG83	2000	192	14.7	0.001	0.001	0.001	0.006	0.001	0.001	0.004	0.001	0.003	0.001
21AUG83	2100	195	13.8	0.001	0.005	0.003	0.007	0.003	0.003	0.006	0.001	0.005	0.004
21AUG83	2200	199	14	0.001	0.007	0.003	0.008	0.003	0.003	0.006	0.001	0.007	0.004
21AUG83	2300	211	12.1	0.001	0.007	0.003	0.008	0.004	0.004	0.006	0.001	0.015	0.008
21AUG83	2400	214	11.8	0.001	0.006	0.003	0.009	0.004	0.001	0.007	0.001	0.009	0.01
22AUG83	100	213	13.1	0.001	0.006	0.001	0.009	0.003	0.001	0.004	0.001	0.01	0.013
22AUG83	200	222	13	0.001	0.004	0.001	0.006	0.001	0.001	0.001	0.001	0.004	0.001
22AUG83	300	220	12.6	0.001	0.003	0.001	0.006	0.001	0.001	0.001	0.001	0.005	0.001
22AUG83	400	228	11.3	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
22AUG83	500	225	10.7	0.001	0.001	0.001	0.004	.	0.001	0.001	0.001	0.003	0.001
22AUG83	600	233	10.6	0.001	0.001	0.001	0.004	.	0.001	.	0.001	0.001	0.001
22AUG83	700	240	9.2	.	0.001	.	0.004	0.001	.	.	.	0.008	0.001
22AUG83	800	304	11.4	0.001	.	0.001	.	0.001	.	0.004	.	.	0.001
22AUG83	900	312	5.3	0.001	0.004	0.001	0.004	0.001	0.011	0.003	0.001	0.009	0.001
22AUG83	1000	.	3.8	0.001	0.003	0.006	0.011	0.02	0.015	0.012	0.001	0.003	.
22AUG83	1100	129	6.2	0.001	0.034	0.006	0.009	0.019	0.001	0.001	0.001	0.001	.
22AUG83	1200	153	6.6	0.001	0.009	0.001	0.006	0.008	0.001	0.001	0.001	0.001	0.001
22AUG83	1300	170	6.9	0.029	0.01	0.003	0.007	0.006	0.001	0.001	0.001	0.001	0.001
22AUG83	1400	217	4.4	0.032	0.005	0.004	0.007	0.003	0.001	0.005	0.001	0.065	0.157
22AUG83	1500	264	3.4	0.01	0.021	0.003	0.007	0.001	0.001	0.004	0.001	0.134	0.11
22AUG83	1600	260	5.5	0.001	0.001	0.003	0.008	0.001	0.001	0.007	0.001	0.023	0.003
22AUG83	1700	204	6.4	0.001	0.001	0.001	0.006	0.001	0.001	0.009	0.034	0.006	0.013
22AUG83	1800	52	7.5	0.019	0.006	0.003	0.013	0.001	0.005	0.016	0.003	0.021	0.026
22AUG83	1900	.	8.3	0.013	0.001	0.001	0.015	0.001	0.004	0.009	.	0.016	0.021
22AUG83	2000	.	6.1	0.001	0.001	.	0.004	0.001	0.001	.	.	.	0.001
22AUG83	2100	300	4.4	0.001	0.001	.	0.003	0.001	0.001	.	.	.	0.001
22AUG83	2200	.	7.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
22AUG83	2300	326	11.4	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
22AUG83	2400	.	4.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SURBER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
23AUG83	100	.	0.0	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	200	42	0.0	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	300	100	3.0	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	400	340	3.2	0 001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	500	334	6.2	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
23AUG83	600	301	5	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
23AUG83	700	315	3.7	.	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
23AUG83	800	291	3	0.001	.	.	.	0.001	.	.	0.001	0.001	0.001
23AUG83	900	343	6.1	0.001	0.001	.	0.001	0.001	0.001	0.001	.	.	0.001
23AUG83	1000	299	3.4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.	.	.
23AUG83	1100	45	2.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.	0.001	.
23AUG83	1200	33	2.9	0.001	0.001	0.001	0.001	0.001	0.003	0.001	.	0.001	0.001
23AUG83	1300	13	2.2	0.001	0.001	0.001	0.003	0.001	.	0.009	0.001	0.003	0.001
23AUG83	1400	220	3.5	0.009	0.014	0.003	0.009	0.004	.	.	0.001	0.004	0.001
23AUG83	1500	320	4.1	0.005	0.011	0.005	0.012	0.017	.	0.023	0.003	.	0.001
23AUG83	1600	266	3.7	0.003	.	0.004	0.006	0.005	0.025	0.008	0.04	0.003	0.001
23AUG83	1700	223	3.6	.	0.004	0.003	0.005	0.003	0.005	0.026	0.008	0.001	0.001
23AUG83	1800	333	2.5	0.001	0.001	0.001	0.006	0.001	0.001	0.028	0.005	0.001	.
23AUG83	1900	315	3.4	0.001	0.001	0.001	0.005	0.001	0.001	0.004	0.003	0.001	0.001
23AUG83	2000	333	4.4	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	2100	350	3.2	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	2200	359	4.3	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	2300	30	4.8	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
23AUG83	2400	15	6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
24AUG83	100	35	6.4	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
24AUG83	200	72	7.6	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
24AUG83	300	05	6.1	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
24AUG83	400	36	7.4	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
24AUG83	500	44	7.8	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
24AUG83	600	46	6.2	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
24AUG83	700	67	5.9	.	0.001	0.001	0.003	0.001	.	0.001	0.001	0.001	0.001
24AUG83	800	48	4.8	0.001	.	.	.	0.001	.	.	0.001	0.001	0.001
24AUG83	900	332	3.5	0.001	0.008	.	0.006	0.001	0.001	.	.	.	0.001
24AUG83	1000	356	3.3	0.003	0.007	0.001	0.019	0.007	0.012	.	.	.	.
24AUG83	1100	326	3,7	0.006	0.006	0.001	0.022	0.007	0.026	.	0.001	0.008	.
24AUG83	1200	303	4.2	0.018	0.01	0.005	0.026	0.01	0.112	0.018	0.001	0.019	0.025
24AUG83	1300	263	4.3	0.041	0.021	0.012	0.035	.	0.049	0.046	0.001	0.04	0.044
24AUG83	1400	325	4.2	0.032	0.018	.	0.073	.	0.049	0.046	0.001	0.019	0.015
24AUG83	1500	279	3.9	0.017	0.011	0.014	.	.	0.165	0.039	0.001	0.01	0.008
24AUG83	1600	321	4.3	0.012	0.000	0.005	0.021	.	0.032	0.019	0.001	0.008	.
24AUG83	1700	329	6.1	0.007	0.006	0.003	0.016	0.004	.	0.014	0.001	0.006	.
24AUG83	1800	358	7.2	0.003	0.003	0.001	0.011	0.001	0.011	0.011	0.001	0.004	.
24AUG83	1900	70	7.9	0.001	.	0.001	0.009	0.001	0.015	0.003	0.001	0.001	0.001
24AUG83	2000	69	0.9	0.01	.	0.013	0.049	0.012	0.029	0.041	0.003	0.008	0.009
24AUG83	2100	58	10.1	0.001	.	0.005	0.019	0.017	0.035	0.021	0.001	0.006	0.001
24AUG83	2200	57	8.6	0.001	0.001	0.001	0.006	0.001	0.012	0.001	0.001	0.001	0.001
24AUG83	2300	67	7.9	0.001	0.001	0.001	0.007	0.001	0.004	0.001	0.001	0.001	0.001
24AUG83	2400	65	7.2	0.001	0.003	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
25AUG83	100	65	8.2	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
25AUG83	200	50	9.1	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
25AUG83	300	41	9.3	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
25AUG83	400	44	7	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
25AUG83	500	58	6.8	0.001	0.001	0.001	0.006	.	0.001	0.001	0.001	0.001	0.001
25AUG83	600	64	6.9	0.001	0.001	0.001	0.005	.	0.001	0.001	0.001	0.001	0.001
25AUG83	700	07	5.4	.	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
25AUG83	800	88	4.9	0.001	.	.	.	0.001	0.001	.	0.001	0.001	0.001
25AUG83	900	88	4	0.005	0.001	.	0.004	0.001	0.001	0.001	0.001	.	0.001
25AUG83	1000	.	4.5	0.027	0.006	0.005	.	0.001	0.001	0.01	.	.	.
25AUG83	1100	.	2.9	0.056	0.046	0.012	.	0.005	0.007	0.02	0.001	0.029	.
25AUG83	1200	327	3.9	0.035	0.029	0.012	.	0.069	0.021	0.042	0.001	0.027	0.019
25AUG83	1300	52	4	0.016	0.016	.	0.04	0.07	0.014	0.02	0.001	0.009	0.014
25AUG83	1400	75	5.3	0.023	0.126	.	0.018	0.012	0.005	0.008	0.001	0.011	0.02
25AUG83	1500	63	5.8	0.017	0.013	0.015	0.015	0.001	0.003	0.009	0.001	.	0.017
25AUG83	1600	9	4.9	0.010	0.007	0.01	0.014	0.001	0.004	0.01	0.001	.	0.021
25AUG83	1700	57	4.5	0.019	0.008	0.007	0.022	0.042	0.005	0.014	0.001	.	0.017
25AUG83	1800	24	5.5	.	0.005	0.006	0.021	0.017	0.009	0.016	0.005	0.007	0.004
25AUG83	1900	34	5.4	.	0.004	0.003	0.015	0.004	0.013	0.011	0.005	0.005	0.001
25AUG83	2000	24	5.9	.	0.005	0.001	0.01	0.001	0.006	0.004	0.001	0.001	0.001
25AUG83	2100	33	7.8	0.03	0.004	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
25AUG83	2200	59	8.1	0.001	0.003	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001
25AUG83	2300	98	8.1	0.001	0.003	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001
25AUG83	2400	112	8.9	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.001	0.001	0.001
26AUG83	100	107	6.2	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
26AUG83	200	117	5.4	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
26AUG83	300	08	3.9	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
26AUG83	400	131	3.7	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26AUG83	500	127	3.2	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001
26AUG83	600	129	1.7	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001
26AUG83	700	115	5.2	.	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
26AUG83	800	135	6.5	0.001	.	.	.	0.001	0.001	.	0.001	0.001	0.001
26AUG83	900	80	5.3	0.009	0.006	.	0.007	0.001	0.004	0.001	0.001	.	0.001
26AUG83	1000	5	3.4	0.005	0.005	0.004	0.016	0.003	0.004	0.004	.	.	.
26AUG83	1100	.	4.3	0.005	0.004	0.004	0.018	0.047	0.003	0.004	0.001	0.001	.
26AUG83	1200	27	4.8	0.012	0.024	0.006	0.017	0.06	0.011	0.012	0.001	0.004	0.004
26AUG83	1300	256	4.2	0.05	0.033	0.012	0.027	0.023	0.018	0.025	0.009	0.026	0.030
26AUG83	1400	258	3.6	0.150	0.571	0.01	0.022	0.015	0.029	0.024	0.007	0.022	0.025
26AUG83	1500	200	3.1	0.106	0.171	0.01	0.028	0.023	0.039	0.022	0.006	0.018	0.012
26AUG83	1600	.	3.5	0.102	0.044	0.029	0.055	0.045	0.025	0.035	0.005	0.021	0.011
26AUG83	1700	274	2.3	0.132	0.038	0.035	0.061	0.029	0.026	0.034	0.000	0.025	0.02
26AUG83	1800	41	6	0.044	0.04	0.022	0.040	0.027	0.036	0.035	0.004	0.013	0.009
26AUG83	1900	343	8.5	0.015	0.015	0.01	0.023	0.019	0.022	0.02	0.001	0.014	0.013
26AUG83	2000	332	5.5	0.004	0.028	0.004	0.017	0.023	0.011	0.008	0.001	0.005	0.004
26AUG83	2100	90	6.7	0.006	0.017	0.006	0.022	0.009	0.01	0.006	0.001	0.007	0.001
26AUG83	2200	59	6.7	0.007	0.015	0.003	0.016	0.008	0.009	0.005	0.001	0.004	0.001
26AUG83	2300	63	5.7	0.004	0.012	0.001	0.012	0.005	0.007	0.003	0.001	0.001	0.001
26AUG83	2400	110	10.1	0.001	0.007	0.001	0.012	0.003	0.007	0.001	0.001	0.001	0.001

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE '	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHRODT	RIVERBANK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
27AUG83	100	153	6.6	0.001	0.006	0.001	0.01	0.001	0.004	0.001	0.001	0.001	0.001
27AUG83	200	110	5.5	0.001	0.005	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	300	185	6	0.001	0.004	0.001	0.008	0.001	0.003	0.003	0.001	0.006	0.001
27AUG83	400	186	4.4	0.001	0.003	0.001	0.006	0.001	0.001	0.001	0.001	0.004	0.001
27AUG83	500	194	6.4	0.001	0.001	0.001	0.007	.	0.004	0.003	0.001	0.003	0.001
27AUG83	600	209	7.9	0.001	0.005	0.001	0.005	.	0.012	0.008	0.001	0.009	0.001
27AUG83	700	211	7.7	.	0.007	0.001	0.008	0.001	.	0.006	0.001	0.010	0.001
27AUG83	800	237	7	0.001	.	.	.	0.001	0.003	.	0.001	0.006	0.001
27AUG83	900	6	4.8	0.005	0.004	.	0.009	0.004	0.017	0.005	0.001	.	0.001
27AUG83	1000	109	3.6	0.007	0.003	0.012	0.011	0.003	0.032	0.006	.	.	.
27AUG83	1100	.	3	0.003	0.001	0.008	0.012	0.001	0.007	0.026	0.006	0.003	.
27AUG83	1200	236	6.9	0.001	0.001	0.001	0.006	0.001	0.001	0.004	0.001	0.001	0.001
27AUG83	1300	228	9.8	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	1400	233	11.1	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	1500	247	11.2	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	1600	238	9.6	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	1700	263	8.7	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	1800	255	10.1	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	1900	225	7.4	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	2000	193	6.7	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	2100	177	8	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	2200	184	8.5	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	2300	215	11.9	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
27AUG83	2400	218	12.5	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
28AUG83	100	336	19.8	0.001	0.001	0.001	0.004	0.001	0.032	0.001	0.001	0.001	0.001
28AUG83	200	316	14.9	0.001	0.001	0.001	0.001	0.061	0.004	0.001	0.001	0.001	0.001
28AUG83	300	.	5.2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28AUG83	400	.	6.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28AUG83	500	124	10.1	0.001	0.001	0.001	0.003	.	0.001	0.001	0.001	0.001	0.001
28AUG83	600	97	9.5	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001	0.001
28AUG83	700	122	10.1	.	0.001	0.001	0.001	0.001	.	0.001	0.001	0.001	0.001
28AUG83	800	138	9	0.001	.	.	.	0.001	0.001	.	0.001	0.001	0.001
28AUG83	900	161	7	0.011	0.001	.	0.001	0.001	0.001	0.001	0.001	.	0.001
28AUG83	1000	185	7.9	0.001	0.001	0.001	0.003	0.001	0.001	0.001	.	.	.
28AUG83	1100	177	5.8	0.024	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	.
28AUG83	1200	.	2.9	0.066	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.024	0.027
28AUG83	1300	193	3.8	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.056	0.118
28AUG83	1400	237	3.5	0.004	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.033	0.066
28AUG83	1500	336	4.4	0.006	0.001	0.015	0.023	0.001	0.001	0.095	0.025	0.015	0.054
28AUG83	1600	7	5.4	0.007	0.004	0.011	0.029	0.003	0.047	0.156	0.033	0.021	0.01
28AUG83	1700	10	11.4	0.006	0.001	0.004	0.01	0.004	0.021	0.011	0.004	0.006	0.001
28AUG83	1800	26	11.1	0.001	0.001	0.001	0.007	0.001	0.001	0.003	0.001	0.001	0.001
28AUG83	1900	13	10.2	0.009	0.005	0.001	0.005	0.001	0.001	0.004	0.001	0.001	0.001
28AUG83	2000	11	8.4	0.017	0.012	0.006	0.018	0.007	0.005	0.008	0.001	0.013	0.011
28AUG83	2100	15	10.3	0.01	0.007	0.003	0.013	0.005	0.009	0.007	0.001	0.01	0.009
28AUG83	2200	16	9.6	0.009	0.009	0.001	0.011	0.006	0.008	0.006	0.001	0.007	0.006
28AUG83	2300	14	10.4	0.006	0.009	0.001	0.013	0.006	0.008	0.004	0.001	0.007	0.005
28AUG83	2400	14	11.6	0.008	0.008	0.001	0.013	0.003	0.005	0.001	0.001	0.009	0.008

PUBLIC SERVICE INDIANA, INC.

SO2 AMBIENT MONITORING DATA(PPM)
GIBSON GENERATING STATION

AUGUST 1983

DATE	HOUR	WIND DIRECTION	WIND SPEED	MT. CARMEL	SCHROOT	RIVERDAIK	LAKEVIEW	SUMNER DITCH	SCOTT DITCH	TOWER	SR 65	E. MT. CARMEL	OLD INDIAN
29AUG83	100	15	11.0	0.005	0.005	0.001	0.01	0.005	0.003	0.001	0.001	0.006	0.004
29AUG83	200	11	11	0.004	0.004	0.001	0.008	0.005	0.003	0.001	0.001	0.004	0.001
29AUG83	300	17	11.1	0.006	0.003	0.001	0.008	0.003	0.003	0.001	0.001	0.003	0.001
29AUG83	400	21	10.9	0.005	0.003	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001
29AUG83	500	32	11.1	0.003	0.001	0.001	0.011	.	0.001	0.001	0.001	0.001	0.001
29AUG83	600	43	7.9	0.001	0.001	0.001	0.007	.	0.001	0.001	0.001	0.001	0.001
29AUG83	700	34	9.5	.	0.001	0.001	0.005	0.001	.	0.001	0.001	0.001	0.001
29AUG83	800	41	8.9	0.001	.	.	.	0.003	0.001	.	0.001	0.001	0.001
29AUG83	900	38	5.3	0.003	0.001	.	0.008	0.003	0.01	0.001	0.004	.	0.001
29AUG83	1000	53	3.4	0.009	0.006	0.011	0.009	0.01	0.05	0.005	.	.	.
29AUG83	1100	71	3.9	0.046	0.015	0.017	0.012	0.013	0.031	0.013	0.012	0.02	.
29AUG83	1200	45	6.3	0.006	0.004	0.008	0.02	0.036	0.022	0.009	0.013	0.015	0.006
29AUG83	1300	331	7	0.001	0.001	0.001	0.018	0.102	0.001	0.003	0.003	0.001	0.001
29AUG83	1400	350	7.7	0.001	0.001	0.004	0.182	0.25	0.001	0.001	0.001	0.001	0.001
29AUG83	1500	2	7.8	0.001	0.001	0.001	0.09	0.055	0.001	0.001	0.001	0.001	0.001
29AUG83	1600	296	7.2	0.001	0.001	0.001	0.133	0.069	0.001	0.001	0.001	0.001	0.001
29AUG83	1700	.	6.7	0.001	0.001	0.001	0.032	0.052	0.001	0.001	0.001	0.001	0.001
29AUG83	1800	32	6	0.001	0.001	0.001	0.061	0.001	0.001	0.001	0.001	0.001	0.001
29AUG83	1900	40	6.3	0.001	0.001	0.001	0.006	0.003	0.001	0.001	0.001	0.001	0.001
29AUG83	2000	23	7.4	0.001	0.003	0.001	0.01	0.001	0.001	0.001	0.001	0.001	0.001
29AUG83	2100	21	9.5	0.001	0.005	0.001	0.008	0.001	0.001	0.001	0.001	0.001	0.001
29AUG83	2200	28	10.1	0.001	0.021	0.001	0.016	0.004	0.001	0.001	0.001	0.001	0.001
29AUG83	2300	36	8.7	0.001	0.023	0.001	0.018	0.008	0.001	0.001	0.001	0.001	0.001
29AUG83	2400	34	7	0.001	0.011	0.001	0.021	0.007	0.004	0.001	0.001	0.001	0.001
30AUG83	100	41	5.3	0.001	0.011	0.001	0.017	0.001	0.003	0.001	0.001	0.001	0.001
30AUG83	200	78	2.5	0.001	0.012	0.001	0.013	0.001	0.003	0.001	0.001	0.001	0.001
30AUG83	300	90	3.1	0.001	0.011	0.001	0.009	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	400	78	3.7	0.001	0.004	0.001	0.005	0.001	0.001	0.001	0.001	0.003	0.001
30AUG83	500	105	4	0.001	0.006	0.001	0.005	.	0.001	0.001	0.001	0.004	0.001
30AUG83	600	123	6.5	0.001	0.006	0.001	0.004	.	0.001	0.001	0.001	0.001	0.001
30AUG83	700	151	8.1	.	0.001	0.001	0.004	0.001	.	0.001	0.001	0.001	0.001
30AUG83	800	155	7.2	0.001	.	.	.	0.001	0.001	.	0.001	0.001	0.001
30AUG83	900	.	7.6	0.001	0.008	.	0.004	0.001	0.006	0.005	0.001	.	0.001
30AUG83	1000	176	9.7	0.034	0.032	0.019	0.024	0.024	0.023	0.034	.	.	.
30AUG83	1100	196	10.7	0.044	0.048	0.044	0.044	0.043	0.034	0.039	0.043	0.043	.
30AUG83	1200	198	10.4	0.027	0.015	0.031	0.029	0.027	0.027	0.023	0.01	0.023	0.021
30AUG83	1300	224	10	0.001	0.005	0.005	0.005	0.004	0.005	0.005	0.009	0.007	0.01
30AUG83	1400	229	9.6	0.001	0.003	0.004	0.006	0.001	0.003	0.004	0.003	0.005	0.013
30AUG83	1500	243	8	0.001	0.003	0.001	0.005	0.001	0.001	0.003	0.001	0.001	0.009
30AUG83	1600	240	9.3	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	1700	233	9	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	1800	255	7.4	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	1900	.	4.7	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	2000	325	4.1	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	2100	75	2.9	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	2200	30	3.6	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	2300	110	2.8	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001
30AUG83	2400	129	3.4	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001

APPENDIX C

MAP: SOUTHWESTERN INDIANA - MELON STUDY AREA 1983

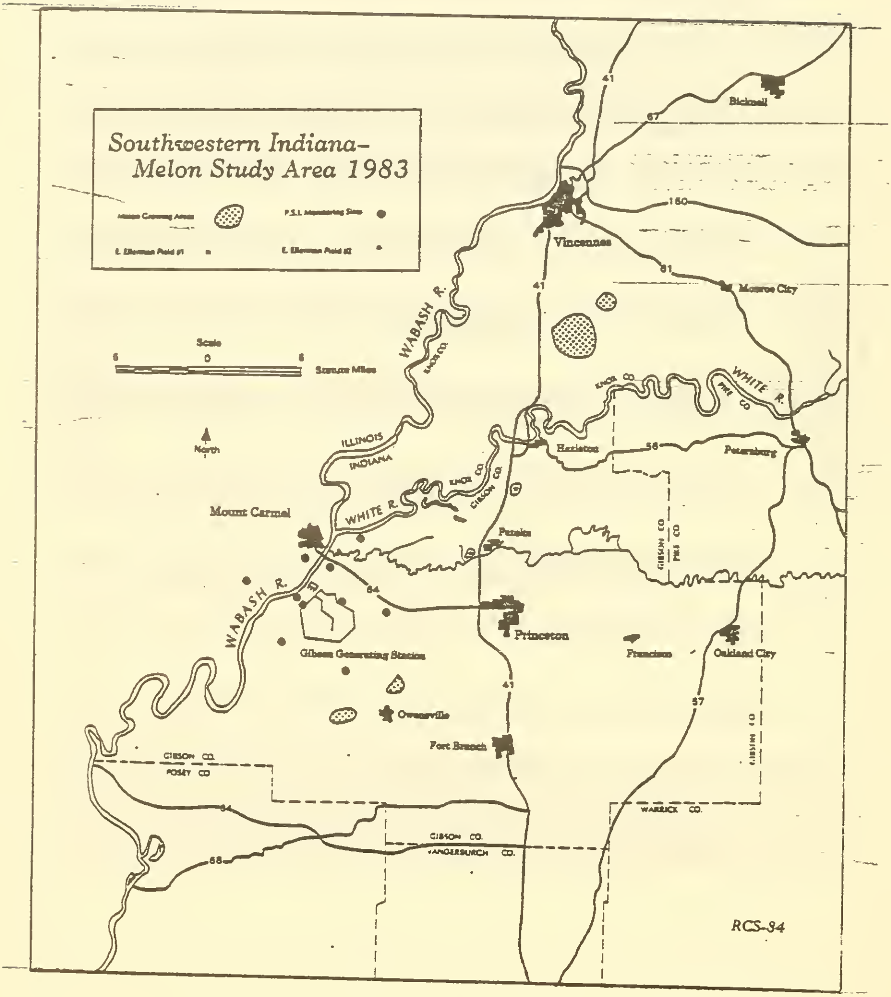


EXHIBIT I-1

American Lung Association of Indiana Testimony on H.R. 3400

Dr. Steven Jay endorsed the Waxman/Sikorski sponsored H.R. 3400 during the February 10, 1984 hearing. He cited statistics which indicated that thousands of individuals would suffer adverse health effects from acid rain. Dr. Jay stated that passage of H.R. 3400 would greatly improve these adverse health effects. We believe the National Ambient Air Quality Standards (NAAQS) provisions developed to comply with the Clean Air Act adequately protect public health. The EPA has responded very well to human health concerns under the NAAQS. Use of the erroneous data by the American Lung Association in support of H.R. 3400 appears to be nothing more than a misguided emotional appeal.

WTS
3/5/84

EXHIBIT J-1

Comments on Dr. Orie Louck's Testimony

It is important to put Dr. Loucks report introduced by Congressman Sikorski during the H.R. 3400 hearing in proper perspective. Dr. Loucks makes the allegation that the epidemic of foliage damage and mortality among conifers in the urban areas of the Ohio Valley is linked with "acid sulfate aerosols". Dr. Louck's bases his opinion on non-systematic, non-quantifiable subjective personal observations, not on a scientifically systematic survey of conifer species throughout the Midwest or of acid sulfate aerosols. Some of the symptoms presented by Dr. Loucks may exist but their significance and extent is certainly questionable. The damage noticed by Loucks could have resulted from a variety of causes both natural and anthropogenic.

As to the "evidence" linking these effects to sulfate aerosols even the Usher and Williams paper cited in Dr. Loucks' own manuscript shows that the damage seen is much more likely to be linked with high ozone levels rather than "acid sulfate aerosols". We must also question Dr. Loucks' statement about a pH of "-0.6" for liquid sulfate aerosols deposited in foliage. Dr. Loucks apparently has done no scientific investigation of this phenomenon in the Ohio Valley.

His statements about strong but unproven evidence explaining forest decline must also be looked at critically. The draft EPA Critical Assessment Document (CAD) states:

> "Causes of forest growth changes will not be determined until a number of important questions have been addressed:
>
> 1. geographical extent of declining growth and increased mortality;
>
> 2. how variable response is in magnitude and period of initiation between different species, soil types, and regions; and
>
> 3. temporal and spatial concurrence of observed responses and patterns of increased precipitation acidity levels and other anthropogenic pollutants such as ozone."

It is questionable whether controls designed to reduce SO2 emission will have any appreciable effect on forest decline. The CAD states:

> "Ozone is the single most important gaseous pollutant harmful to plant life . . . Direct effects due to ozone include foliar injury and growth and yield reductions in numerous agronomic and forest species."

Dr. Loucks should be careful when discussing recent work on the use of tree ring core analysis in assessing the influence of natural and anthropogenic stresses on regional forest growth patterns. Quantifying a change in tree growth rate by this method and relating that change to specific causes are two separate and complex problems. Extensive scientific work must be done first to ascertain causes, correlation indices for various pollutants with occurrence of air episodes, correlations among emissions and deposition of sulfate and hydrogen ions, and quantifying various trace metal content in tree rings.

RCS
3/5/84

STATEMENT OF

THE HONORABLE
DOUGLAS A. HUNT
STATE SENATOR
INDIANA STATE SENATE

MY NAME IS DOUGLAS HUNT. I AM A MEMBER OF THE INDIANA STATE SENATE FROM THE TENTH SENATE DISTRICT.

I APPRECIATE THE OPPORTUNITY TO COME BEFORE YOU TODAY TO DISCUSS HR 3400 AND THE IMPLICATIONS FOR THE PEOPLE OF INDIANA.

YOUR COMING TO INDIANA DEMONSTRATES ADMIRABLE GOODWILL AND YOUR INTEREST IN ACCOMMODATING THE VIEWS AND INTERESTS OF PEOPLE IN THIS PART OF THE NATION WITH RESPECT TO WHAT IS INDEED A NATIONAL PROBLEM.

I WOULD LIKE TO RECIPROCATE BY SAYING FIRST THAT I DO NOT PROPOSE TO CHALLENGE THE ESSENTIAL PURPOSE AND THE PARTICULAR OBJECTIVES OF HR 3400. OTHERS MORE COMPETENT ON THESE POINTS THAN I AM WILL ADDRESS THE SCIENTIFIC ISSUES CONCERNING ACID RAIN AND ITS MITIGATION.

IF ABOUT 25 MILLION TONS PER YEAR OF SULFATE EMISSIONS ARE DEPOSITED FROM SOURCES IN THIS COUNTRY AND IF ABOUT 17 MILLION TONS OF THAT, OR EVEN A MAJOR FRACTION OF THAT AMOUNT, ISSUES FROM ELECTRICIAL GENERATING STATE STATIONS, THEN THOSE OF US IN THE OHIO VALLEY DO HAVE AN OBLIGATION TO CONTRIBUTE CONSTRUCTIVELY TO THE MAKING OF POLICY TO REDUCE THOSE EMISSIONS.

I AM NOT AN EXPERT WITNESS ON ANY SINGLE TOPIC WITHIN THE ACID RAIN ISSUE, BUT AS AN ELECTED STATE OFFICIAL OF THE STATE'S KEY POLICY-MAKING BRANCH, THE LEGISLATURE, PERHAPS MY PERSPECTIVE IS AS CLOSE TO YOUR OWN AS THAT OF ANY WITNESS BEFORE YOU TODAY.

OUR, PRECISE POINTS OF VIEW DIFFER BECAUSE MY POINT OF VIEW LITERALLY IS IN INDIANA AND I AM OBLIGED TO GIVE GREAT WEIGHT TO THE INTERESTS OF MY STATE. SO IN RETURN FOR ACCEPTING, AT LEAST FOR THE PURPOSE OF THESE COMMENTS, THE RESPONSIBILITY TO MAKE MAJOR SULFUR DIOXIDE EMISSION REDUCTIONS IN THE YEARS AHEAD, LET ME ASK YOU TO RECOGNIZE THAT OUR INTEREST IN INDIANA AND ELSEWHERE IN THE MIDWEST IN PROTECTING OUR ECONOMY IN GENERAL AND OUR COAL MARKETS IN PARTICULAR IS LEGITIMATE.

FURTHERMORE, I WOULD EVEN SUGGEST THAT IN SOME WAYS THERE IS IN THIS DILEMMA AN OPPORTUNITY FOR THOSE OF US IN THE MIDWEST, WITH APPROPRIATE FEDERAL POLICY AND FEDERAL SUPPORT.

I ACCEPT, FOR NOW, THE FUNDAMENTAL NATURE OF HR 3400. I WILL SUPPORT THE BASIC GOAL OF REDUCING EMISSIONS BY 10 MILLION TONS. I ACCEPT AND WELCOME THE BILL'S FUNDING MECHANISM, WHICH RECOGNIZES THE NATIONAL NATURE OF THE PROBLEM. I DO NOT EVEN BELIEVE THAT THE COMPLIANCE SCHEDULE, THE SEVEN YEARS FROM THE DATE OF BILL INTRODUCTION, AS DETERMINED IN SECTION 185 (C) (2) IS UNDULY HASTY.

BEYOND THOSE FEATURES, HOWEVER, THE BILL MAKES SOME ASSUMPTIONS WHICH I STRONGLY CHALLENGE.

I BELIEVE THAT, TO PRESCRIBE A FAIRLY SPECIFIC REMEDY, THE INSTALLATION OF SCRUBBERS, PRESUMES TO KNOW MORE ABOUT THE MARKET AND THE FUTURE THAN IS WARRANTED.

HR 3400 HAS SECOND-GUESSED THE MARKET; AND, AS THE SINGLE BIGGEST FACTOR IN DETERMINING HOW THE MARKET WILL DEAL WITH SULFATE EMISSIONS, THE BILL WILL SHAPE THE MARKET RESPONSE FOR YEARS TO COME.

THE BIGGEST SINGLE MISJUDGEMENT, IN MY OPINION, IS THE DICTATION OF A SINGLE TECHNOLOGICAL FIX AND THE FORCING OF SUCH AN EARLY COMMITMENT AMONG UTILITIES TO THAT CHOICE OF TECHNOLOGY.

THE REQUIREMENT TO SUBMIT NOT LATER THAN JANUARY 1, 1985, OR THE EQUIVALENT ADJUSTED DATE, "A COMPLIANCE SCHEDULE INCLUDING INCREMENTS OF PROGRESS" TOWARD "THE CONSTRUCTION AND INSTALLATION OF THE TECHNOLOGICAL SYSTEM OF CONTINUOUS EMISSION REDUCTION," FORCES A PLANNING COMMITMENT, AND THEREAFTER A CONTRACTUAL COMMITMENT, TO THE SCRUBBER OPTION.

I KNOW THAT SCRUBBERS NECESSARILY MUST PLAY A LARGE ROLE IN ANY MITIGATION PROGRAM. I ALSO KNOW THAT MY FOLLOWING COMMENTS CAN

BE TAKEN AS UNDULY OPTIMISTIC AND THAT POLICY SHOULD NOT BE MADE ON THE BASIS OF OPTIMISM, ALTHOUGH IT OFTEN MUST BE MADE ON THE BASIS OF OUR BEST RISK ASSESSMENT.

I AM AMONG THE MINORITY OF THOSE IN GOVERNMENT AND THE COAL INDUSTRY WHO SEE THE POSSIBILITY OF A CONVERGENCE OF THE SCHEDULE CALLED FOR IN THIS BILL AND THE PROJECTED TECHNOLOGICAL PROGRESS FOR DEALING WITH HIGH SULFUR COAL IN WAYS OTHER THAN WITH SCRUBBERS.

THESE TECHNOLOGIES, SPECIFICALLY COAL PREPARATION AND, IN THE LONGER RUN FLUIDIZED BED COMBUSTION, GET US IN INDIANA EXCITED ABOUT THE RENEWAL OF POSSIBILITIES NOT ONLY FOR OUR COAL MARKET BUT FOR OUR INDUSTRIAL SECTOR AS WELL.

THESE TECHNOLOGIES PRESENT THE OPPORTUNITY TO MAKE MEANINGFUL AGAIN THE INHERENT ADVANTAGES OF LOWER ASH CONTENT, HIGHER BTU CONTENT, AND PROXIMITY TO MARKETS OF OUR PRODUCT, WHICH ADVANTAGES ARE NOW OUTWEIGHED BY THE PROBLEM OF HIGH SULFUR CONTENT.

I DO NOT BELIEVE THAT THE PACE CALLED FOR IN HR 3400 AND THE PACE OF DEVELOPMENT OF COAL CLEANING ARE THAT FAR APART. FURTHERMORE, THERE IS NO QUESTION THAT ADVANCED PHYSICAL CLEANING CAN MAKE A SIGNIFICANT SHORT TERM CONTRIBUTION, ALTHOUGH PROBABLY NOT WITH MUCH OF THE COAL MINED IN INDIANA.

CHEMICAL COAL CLEANING, ON THE OTHER HAND, HAS DEMONSTRATED THE POTENTIAL TO REMOVE VIRTUALLY ALL SULFUR, AND THE SCHEDULE FOR THAT TECHNOLOGY IS NOT AS FAR OFF AS SOME SUPPOSE.

IN A RECENT CONVERSATION WITH DOCTOR ROBERT MYERS, MANAGER OF TRW, INC COAL CLEANING PROJECT, I LEARNED THAT THE CURRENT SCHEDULE CALLS FOR A COMMERCIAL PLANT TO BE OPERATING IN THE 1989-1990 TIME FRAME. THE PROSPECTS OF A RAPID SPREADING OF THIS OR SIMILAR

TECHNOLOGIES INTO THE MARKET IS FIRM ENOUGH TO JUSTIFY THE ATTENTION OF POLICY-MAKERS WORKING ON THE ACID RAIN ISSUE.

IF THE ORIGINAL INTERVALS IN HR 3400 ARE MAINTAINED AND THE COMPLIANCE SCHEDULE IS ADJUSTED ACCORDING TO THE DATE OF ENACTMENT, WHICH MOST OBSERVERS BELIEVE TO BE IN 1985 AT THE EARLIEST, THEN COMPLIANCE MUST COME IN THE 1991-92 RANGE, WHICH WILL PERMIT THE USE OF COAL CLEANING AS A MAJOR REMEDY IN MITIGATING SULFATE EMISSIONS.

IT IS ALSO POSSIBLE TO ACCELERATE SOMEWHAT THE RATE OF DEVELOPMENT BY PUTTING SIGNIFICANT RESOURCES INTO THE EFFORT. TO AN EXTENT THERE IS A TRADEOFF BETWEEN TIME AND MONEY, ALTHOUGH THE INCREMENTS OF TIME GAINED QUICKLY SHRINK AT THE MARGIN EVEN WITH INCREASED SPENDING.

BUT THERE IS NO QUESTION IN MY MIND THAT, JUST AS THE SYNTHETIC RUBBER INDUSTRY WAS DEVELOPED IN WORLD WAR II AND JUST AS OTHER INDUSTRIES SUCH AS THE SPACE AND DEFENSE INDUSTRIES HAVE RESPONDED TO MAJOR INFUSIONS OF GOVERNMENT RESOURCES, THAT THIS ENERGY INDUSTRY WILL RESPOND WITH UNEXPECTED VIGOR. ONE DEFICIENCY, BY THE WAY WHICH EXISTS IN BOTH THE COAL AND UTILITY INDUSTRIES, IS A LACK OF ENTREPRENEURIAL SPIRIT. THIS SPIRIT MUST BE PRESENT IF THE ENTERPRISES NECESSARY TO BRING TECHNOLOGY TO BEAR ON THESE MATURE INDUSTRIES ARE TO BE CARRIED OUT.

WITH MORE PUBLIC MONEY INVOLVED THERE WILL BE MORE WASTE THAN MIGHT NORMALLY BE EXPECTED IF PRIVATE MONEY ONLY WERE AT RISK; BUT AT THE SAME TIME THE PACE WILL NOT BE AS SLOW AS IT WOULD BE IF THE PRIVATE MARKET ALONE WAS PROVIDING CAPITAL AND LEADERSHIP AT NORMAL LEVELS OF RISK.

I BELIEVE THAT THE NATURE OF THE PROBLEMS STANDING IN THE WAY OF DEVELOPMENT PERMIT SOME OPTIMISM. WHILE WE HAVE MORE TO LEARN ABOUT THE BASIC CHARACTER OF COAL, MOST PROBLEMS INVOLVE THE

DESIGN OF SYSTEMS AND NOT BASIC RESEARCH.

I DO NOT ASK THE FEDERAL GOVERNMENT TO BECOME THE SOLE UNDERWRITER OF DEVELOPMENT EFFORTS. IN INDIANA THE POTENTIAL EXPANDED MARKETS FOR A MORE REFINED COAL PRODUCT JUSTIFY SUBSTANTIAL STATE PARTICIPATION IN DEVELOPMENT EFFORTS.

SOME ALSO ASSERT THAT WE HAVE MUCH TO GAIN IN OUR OWN STATE ENVIRONMENT FROM REDUCING SULFATE EMISSIONS. FURTHERMORE, OUR INDUSTRIAL BASE DEPENDS UPON THE EFFICIENCY OF OUR INDUSTRIAL BOILERS AND THE QUALITY AND COST OF FUEL SUPPPLY TO THOSE BOILERS.

I WOULD ALSO SUGGEST THAT MUCH OF THE INNOVATION IN ECONOMIC DEVELOPMENT HAS BEEN FORTHCOMING FROM STATE AND LOCAL GOVERNMENTS AND THAT GIVEN THE ABILITY TO TREAT THE PROBLEM OF HIGH SULFUR INDIGENOUS COAL AS AN OPPORTUNITY, POLICY-MAKERS IN INDIANA WILL RESPOND WITH APPROPRIATE STATE PARTICIPATION IN ANY EFFORT.

NO MATTER HOW HR 3400 IS ULTIMATELY DRAFTED WITH RESPECT TO COMPLIANCE, THE OUTCOME WILL OF COURSE BE A DISTORTION OF THE MARKETPLACE. EMISSION STANDARDS NOW IN PLACE DISTORT THE MARKET. THE AMERICAN PEOPLE HAVE DIRECTED POLICY-MAKERS TO ASSIGN A COST TO THE SOCIAL VALUES OF CLEANER AIR, WATER AND SOIL AND POLICY-MAKERS HAVE RESPONDED.

THE UNIT TRAINS CARRYING LOW SULFUR COAL FROM THE WEST TO THE MIDWEST ARE SYMBOLS OF MARKET DISTORTIONS. WE PAY A PREMIUM IN TERMS OF MORE ASH, IN LOWER BTU CONTENT, AND IN HIGHER TRANSPORTATION COSTS. THAT IS THE CAPITALIZED COST OF THE SOCIAL VALUE OF A HEALTHIER ENVIRONMENT.

THE QUESTION WITH HR 3400 IS THE MANNER IN WHICH IT WILL DISTORT THE MARKET, WILL IT BE A DISTORITON WITH THE GRAIN OF THE MARKET OR

AGAINST IT. I BELIEVE THAT THE BILL IN ITS CURRENT FORM WILL ESTABLISH GROSS TECHNOLOGICAL DISTORTIONS OF THE MARKET.

INJECTING 14 BILLION DOLLARS INTO SCRUBBERS OR DRIVING UTILITIES TO RESORT TO SCRUBBERS FORCES THE MARKET TO USE A SYSTEM WHICH HAS BECOME EFFECTIVE IN REDUCING EMISSIONS, BUT WHICH RESPRESENTS A MISALLOCATION OF CAPITAL TO SOLVE THE PROBLEM.

UNLIKE SOME OTHER APPROACHES, WHICH ADMITTEDLY ARE NOT IMMEDIATELY FEASIBLE, SCRUBBERS HAVE NO SUPPLEMENTAL BENEFITS BEYOND THE REMOVAL OF SULFATES. THEY REDUCE OUTPUT SIGNIFICANTLY, THEY REDUCE BOILER EFFICIENCY, THEY CAUSE SIGNIFICANT INCREASES IN OPERATING COSTS GENERALLY AND IN WASTE DISPOSAL IN PARTICUALR.

CAPITAL SHOULD BE CONCENTRATED EARLIER IN THE PROCESS AT THE PRECOMBUSTION AND COMBUSTION STAGES.

BY ITS SINGLE-MINDED DRIVE TOWARD SCRUBBING, HR 3400 IS DIVERTING CAPITAL AWAY FROM WHERE THE CAPITAL ALLOCATION OF THE MARKET WOULD NATURALLY GO. THE BILL WOULD PROBABLY RETARD THE DEVELOPMENT OF WHAT MOST OF US WOULD CONSIDER TO BE THE BEST SOLUTIONS TO THE PROBLEM OF BURNING HIGH SULFUR COAL.

THE BILL SHOULD GO WITH THE GRAIN OF THE MARKET, USING MARKETS FORCES FOR ITS LAUDABLE PURPOSES AS MUCH AS POSSIBLE. IT SHOULD USE THE LEAST AMOUNT OF PRESCRIPTIVE REMEDY POSSIBLE WITHOUT NECESSARILY REDUCING THE GOALS TO BE ACHIEVED.

I BELIEVE THAT HR 3400 COULD AND SHOULD BE DRAFTED IN SUCH A WAY AS TO ACCELERATE SOLUTIONS TOWARD WHICH THE MARKET NOW TENDS. AND REGARDLESS OF THE PROGRESS ON THIS LEGISLATION IN 1984, I BELIEVE THAT EFFORTS SHOULD BE MADE TO HASTEN THESE TECHNOLOGIES TO MARKET.

THIS WOULD REQUIRE SUBSTANTIAL SUPPORT BEYOND THE CURRENT

DEPARTMENT OF ENERGY REQUEST FOR FOUR MILLION DOLLARS FOR DEVELOPMENT OF ADVANCED PHYSICAL CLEANING AND 3.5 MILLION DOLLARS FOR DEVELOPMENT OF CHEMICAL CLEANING IN FY 85.

WE SHOULD NOT ASSUME THAT CHEMICAL COAL CLEANING IS NOT RELEVANT TO THE PURPOSE OF HR 3400, NOR SHOULD WE OVERLOOK THE FACT THAT THE MOST EFFECTIVE NEAR TERM SOLUTION IS PROBABLY ADVANCED PHYSICAL CLEANING.

IN THE SAME MANNER, REGARDLESS OF ACTION TAKEN OR NOT TAKEN BY THIS CONGRESS, THE NEED TO CONTINUE TO LEARN ABOUT ACID RAIN SHOULD BE SUPPORTED.

EMISSION, TRANSPORT, AND DEPOSITION OF SULFATES AND THEIR ENVIRONMENTAL EFFECTS INVOLVE MORE THAN ASSESSING CHEMICAL AFFECTS. IT INVOLVES MORE THAN LEARNING IN GENERAL HOW A PARTICULAR PROCESS IN THE BIOSPHERE WORKS. IT REQUIRES THE INTEGRATION OF THE CHEMICAL AND BIOSPHERIC KNOWLEDGE WITH EXACT KNOWLEDGE OF WHERE THE MATERIAL COMES FROM AND WHERE IT GOES.

ACID RAIN STUDIES MUST INCLUDE A FEEDBACK MECHANISM TO MAKE SURE THAT AS KNOWLEDGE IS REFINED SO IS THE REGULATORY PROGRAM TO REDUCE EMISSIONS. IN THE MEANTIME I BELIEVE THAT POLICY-MAKERS MUST BE CAREFUL NOT TO PRESCRIBE OR COMMIT BEYOND THEIR ABILITY TO MEASURE, WITH REASONABLE PROBABILITY, THE CONSEQUENCES OF GOVERNMENT ACTION.

TODAY JUST OVER IN THE STATE HOUSE, MANY PROPOSED PIECES OF LEGISLATION ARE MEETING THEIR FATES. SOME OF THEM ARE DYING FOR A LACK OF GOODWILL AND BECAUSE OF UNWILLINGNESS TO COMPROMISE ON THE PART OF PARTIES INVOLVED.

AS I SAID IN MY OPENING COMMENT, I RESPECT THE GOODWILL SHOWN BY YOUR COMING HERE. I DO HOWEVER HAVE DOUBTS THAT THE VARIOUS

CONSTITUENCIES INVOLVED HAVE CAUGHT UP WITH POLICY-MAKERS IN THEIR WILLINGNESS TO ARRIVE AT AN ACCORD.

HERE IN INDIANA WE WILL DO OUR PART. BUT WE MUST ALSO STAND UP FOR OUR REGION. THE TWO IDEAS ARE NOT NECESSARILY IN CONFLICT.

AMERICAN HISTORY HAS IN LARGE PART CONSISTED OF THE NATION SUPPORTING THE DEVELOPMENT--AND NOW WE WOULD SUGGEST THE REDEVELOPMENT--OF ONE REGION OR ANOTHER.

BUT WE ALSO HAVE EXAMPLES OF ONE REGION OR ANOTHER BEING EXPLOITED, AND WE WILL ATTEND TO THAT RISK EVEN AS WE ATTEMPT TO WORK TOWARD A NATIONAL CONSENSUS.

THIS HEARING IS A CONTRIBUTION OF GOOD WILL TO THE COAL-BEARING, COAL-USING STATES OF THE OHIO VALLEY . WE TAKE YOUR MEETING HERE TO BE AN ACT OF SUBSTANCE AND NOT JUST A GESTURE.

IN THAT SPIRIT WE OFFER TO WORK TOGETHER.

THANK YOU FOR THE OPPORTUNITY TO APPEAR BEFORE YOU TODAY.

TESTIMONY OF
DON WILKINSON
ON BEHALF OF
THE INDIANA DIVISION
IZAAK WALTON LEAGUE OF AMERICA

My name is Donald S. Wilkinson. I am pleased to have the opportunity to submit testimony to the Subcommittee on the subject of acid rain control legislation.

The Indiana Division of the Izaak Walton League represents over 5000 Hoosiers from all parts of the state and from all walks of life. Many of our members are from coal producing regions of this state. I mention this because although our belief in protecting the environment forms the very core of our organization, we do not wish to turn a deaf ear towards the concerns of others that are involved in the effort to clean up our air. That concern has sparked many hours of meetings with people representing all sides of the issue including the United Mine Workers of America, Indiana and Michigan Power Company, The Hudson Institute, and the Hoosiers for Economic Development to mention just a few.

These discussions have reaffirmed our position that it is possible to have both full employment and a healthly environment in the state of Indiana.

In our view, the mounting concern about acid precipation is based on real and potentially very serious threats to our natural resources - not only here in Indiana but also throughout the country. Because of this concern, the Indiana Division of the Izaak Walton League strongly supports the Waxman-Sikorski Bill

(H.R. 3400). We believe that this legislation will enable uniform and a fair system of reducing emissions without creating a competitive edge for any one part of the country.

Indiana has a strong coal industry that provides thousands of jobs and millions of dollars to the economy. Some 30 million tons of coal are extracted annualy in the state. However, only 22 million tons of the this coal is used within the state - almost all of it used for generating steam. Indiana coal mines employ approximately 2,500 miners and produce about 20,000 coal related jobs throughout the state.

Indiana coal is high sulfur coal. But the important fact to remembers is that this high sulfur Indiana coal contains more heat per ton that low sulfur western coal. In a guest opinion article in the April, 1983 issue of The Indiana Mineworker, Lt. Governor John Mutz stated:

> "Cleaning emissions from utilities and plants is crucial to the future of the Indiana coal industry. We have a classic "bad news - good news" dilemma. The bad news is that Indiana coal contains more sulfur than can be allowed in the atmosphere in some places, according to environmental guidelines. The good news is that Indiana coal contains much more heat energy per ton than low sulfur western coal. So it the sulfur problem can be overcome Indiana coal becomes a superior product. This research (by the Indiana Electric Association) is a good example of how high technology or the results of its appplication can create jobs."

There is other evidence that demonstrates that the use of high BTU, high sulfur coal with scrubbers in Indiana would be more cost-effective than using low BTU, low sulfur, western coal. In a paper by Russell Stilwell, Indiana Coordinator, United Mine Workers Political Action Committee, July, 1982, the costs of scrubbers and the cost of various fuels were compared at the Rockport Power Plant. Indiana coal had an average sulfur content of 2.78 percent with a heat content of 21.688 million BTUs per ton. In contrast, Wyoming coal had a sulfur content of 0.65 percent however its heat content was only 21.338 million BTUs per ton. When transportation costs are considered, he found that Indiana coal cost about $1.06 per million BTU delivered. However the delivered cost of the Wyoming coal was $2.01 per million BTU. Even including the capital cost and maintenance of the needed scrubbers at the Rockport plant, Stilwell found that Indiana electricity customers would save $2 to $12 billion in fuel costs over the life of the plant by using locally available coal.

Stilwell concludes that:

> "All of the foregoing shows that the customers of I/M, the workers and the State of Indiana would benefit if the I/M Rockport facility would burn Indiana coal. Why is I/M going out of state for their coal? Apparently, I/M will go out of state to preserve higher profits for their investors while insuring higher utility bills for their customers. Is the sulfur content too high to be cleaned effectively with scrubbers? NO! Present day technology exists to install scrubbers on powerplants that remove imnpurities to meet the rigid EPA regulations. All new powerplants ust meet this scrubber requirement today. The Rockport plant should do so as well."

These figures that demonstrate the cost advantages of burning Indiana coal with scrubbers were not developed by the Izaak Walton League or the Indiana Clean Air Coalition. Rather they are compliation of data from EPA, DOE, AEP, and UMWA to support the need to develop jobs in the Indiana coal industry. However, we believe that these figures effectively make the case that we can have both clean air and full employment in the state of Indiana.

In conclusion, the Indiana Division of the Izaak Walton League urges members of the subcommittee to strongly support the provisions of the Waxman-Sikorski bill now pending in that subcommittee. We believe that this legislation would not only improve the health and environment of Hoosiers but also enhance its economy as well.

Thank you.

Guest opinion **Lt. Gov. John Mutz**

I&M agreement to seek Hoosier coal is progress

The October edition of *The Indiana Mineworker* reported on the start of a campaign to encourage Indiana and Michigan Electric Company to burn Indiana coal. Your president, Larry Reynolds, officials of the Indiana Electric Association and legislators were in my office in February when the first success in that campaign was announced. I&M said it would seek bids from Indiana coal producers to supply coal at the twin Rockport generators.

This agreement doesn't guarantee I&M will burn Indiana coal at Rockport — nor does it stipulate how much Indiana coal it will buy to mix with low sulfur coal from the west. But it is a step in the right direction.

For the short run, the campaign to encourage Indiana coal production for Rockport should continue. But even more promising for the Hoosier coal industry, and the jobs of thousands of Indiana miners, is a new cooperative attitude between the UMWA, members of the IEA and state government.

Everyone recognizes that we all benefit by mining and burning Indiana coal, and there have been some steps taken to increase the use of our home-state product.

To begin with, the IEA member utilities have re-affirmed that they will give first preference to Indiana coal when it conforms to the utility's requirements and allows the utility to charge the lowest possible rates.

Looking further ahead, the IEA agreed to help support a flue gas desulfurization research project being evaluated by the Indiana Department of Commerce Energy Division. This important research could yield a relatively low-cost method of removing sulfur from utility and industry stack gasses. If successful, it could overcome the major objection utilities have about using Indiana coal.

Cleaning emissions from utilities and plants is crucial to the future of the Indiana coal industry. We have a classic "bad news, good news" dilemma. The bad news is that Indiana coal contains more sulfur than can be allowed into the atmosphere in some places, according to environmental guidelines. The good news is that Indiana coal contains much more heat energy per ton than low sulfur western coal. So, if the sulfur problem can be overcome, Indiana coal would be a superior product.

The research is a good example of how high technology, or the results of its application, can create jobs.

There are several problems surrounding the use of Indiana coal that need to be worked out in order to keep Indiana miners where they belong -- on the job. Governor Robert Orr will name an Indiana Coal Commission to examine regulations, technology and cost factors affecting Indiana coal. Other factors, such as rail routes, the availability of coal cars when and where they are needed and the health and safety of miners are also likely to get commission attention. The commission will report to the General Assembly and make detailed recommendations about what can be done to strengthen our state's coal industry.

More efforts need to be made to sell Indiana coal in the U. S. and overseas. The Ohio River, through the state-operated Southwind Maritime Center port at Mount Vernon and other ports, is a promising avenue for Indiana coal. Utilities in Europe already use coal from Indiana mines, and a recent trip coordinated by the Indiana Department of Commerce International Trade Division could result in expanding markets in Europe and the Middle East. A worldwide economic recovery will certainly increase the export sales of our product, just as a U. S. upturn will help sales in this country.

Some may be tempted to say that we are promoting the burning of Indiana coal only because it is our local product. Behind that comment is the feeling that we are pushing an inferior coal that fouls the air. This is simply not true. Indiana coal can be safely burned right now in many places including most locations in our own state. New technology will help remove the sulfur, and then Indiana will be sitting on about eight billion tons of a much sought-after energy source. After all, utilities can generate a given amount of power with less Indiana coal compared to the amount of western coal required to produce the same power. That's a savings for the utilities and users of electricity -- all of us.

Last year, about 4.6 billion Hoosier dollars went out of state to pay for energy. That is a tremendous amount of money, and some of that could stay here if we can get the Indiana coal industry back to full production.

President Reynolds has helped bring the urgent problems of the Indiana coal industry to the attention of state government and the electric utilities. We have a unique opportunity to work together to create more jobs in the mines, and that is the goal we share in this new, united effort to burn Indiana coal.

STATEMENT OF
AMAX COAL COMPANY

AMAX Coal Company is a division of AMAX Inc., a diversified natural resource minerals and energy development company with worldwide operations. The Company explores for, refines and sells a wide variety of minerals and metals, and has substantial interest in coal, petroleum and natural gas.

As the third largest producer of domestic coal, AMAX Coal Company is very interested in any legislation involving the issue of acid rain. Naturally, our concern involves the potential impact this type of legislation may have upon coal production patterns, marketability, and the certain loss of thousands of jobs. Our concern with the issue, however, has a much more fundamental basis. It involves the moral responsibility to balance all the factors involved in an issue when establishing public policy. We believe that many of the acid rain control bills introduced in Congress thus far, have been drafted without giving more than cursory consideration of the long-term burden these bills would place on industry, the citizen consumer, and the economic health of the country.

AMAX Coal recognizes that an attempt was made in H.R. 3400 to address some of the issues ignored in most other acid rain control bills. We praise the author's intentions. However, we must object to the proposed legislation since the two basic premises of the bill are seriously flawed. First, current scientific knowledge does not support an expensive emission-reduction program. Second, the reduction-allocation formula ignores the spatial relationship between source emissions and sensitive receptor areas.

AMAX Coal Company's foremost objection to H.R. 3400 is based on the inadequacy of the scientific understanding of the phenomenon. We recognize that you are aware of the controversy surrounding every scientific aspect of this issue. In an effort to avoid redundancy, we will not debate the scientific facts in any detail. Suffice it to say, we believe it would be unreasonable to implement a questionable and costly control program without benefiting from the vast amount of new understandings the scientific community is currently developing. Dr. Kenneth Rahn, among others, is making exciting progress in elemental aerosol tracer research and long-range transport study. Likewise, it is irrational to ignore the questions raised in the latest USGS water-quality study concerning sulfate concentrations and acid precipitation. (An Evaluation of Trends in the Acidity of Precipitation and the Related Acidification of Surface Water in North America, by John T. Turk, 1983) Neither can the results of the recent Environmental Research and Technology, Inc. long-time trend analysis concerning the discrepencies between sulfate and nitrate concentrations and pH stability in rainfall be ignored. (Analysis of Trends in Historical Acid Precursor Emissions and Their Airborne Precipitation Products, November 1983.) Lastly, John Deutch, Chairman of the Science Advisory Board's Ad Hoc Committee to review the National Acid Precipitation Assessment Program recently published a final report indicating that there are fundamental gaps in both research resource allocation and the understanding of the basic sciences involved in the issue. A summary of his recommendations is attached. (For a further discussion of the vast scientific uncertainties surrounding this issue, please refer to the written statement of the Indiana Coal Council.)

Aside from our opposition to a scientifically unfounded control program, we believe the most significant shortcoming of H.R. 3400 is the bill's unsupportable premise that the reduction of primarily one pollutant in one region of the country will result in equal reductions in the deposition or damage to sensitive areas of the country located hundreds of miles from the targeted sources.

This approach disregards the results and the recommendations of many of the most recent scientific studies including the June 1983, National Academy of Science's report which concluded that effective deposition controls would require uniform reductions from all sources located in the sensitive region. (pp 10 and 11, NAS, June 1983.) The authors also concluded that, generally, the further a source is located from a receptor area, the smaller the impact on that site per unit of mass emitted. (pp 10, NAS, June 1983.) H.R. 3400, like other acid rain control bills, contradicts this most basic premise by using a targeted reduction formula based on an emission rate threshold.

By relying on the same arbitrary reduction allocation formula used in other bills, the authors of this bill elect to limit the potential effectiveness of their control program development, while simultaneously exacerbating the inequitable costs for certain regions of the country. The formula is based on an arbitrary emission rate threshold which excludes states where a large number of sources emit at a low rate. We question the true intent of this bill because it effectively excludes many states having large industrial emissions since the reduction formula targets utility emissions alone. While the bill is presented as a "national bill", 21 of the 48 contiguous states are exempted or required to make only minimal reductions. In contrast, eight Midwestern states would be required to bear the major burden of the reductions: Indiana, for instance, would be required to reduce 63 percent of its 1980 emissions.

Additionally, the allocation formula ignores the fact there are a number of states in which SO_2 emissions from non-utility sources exceed that state's emissions from utilities. Six of these states are in the Northeast and located much closer to those areas sensitive to acid deposition than the Midwestern states. Additionally, the reduction allocation formula ignores the contribution of SO_2 and NO_x emissions originating from the residual fuel oils, paper manufacturing and industrial boilers used in the Northeast and most mobile sources in heavily populated areas such as New York.

In New York, non-utility sources contribute almost 50 percent of a total SO_2 emission of 944,000 tons--an amount exceeded by only nine other states, and more than all of the Northeastern states combined. Despite its presentation as a nation-wide bill, H.R. 3400 is a regional bill requiring reductions in emissions from primarily one source, (utilities) and primarily one region (the Midwest). If the acid rain issue is a problem that requires debate at the national level of government, then it should be addressed collectively as a national problem. Likewise, if SO_2 and NO_x emissions are acid rain precursors and pose an environmental risk, then all SO_2 and NO_x emissions pose an equal risk. There is no logical reason for the exclusion of certain source emissions if the true intent of this acid rain program is to control major precursors of the phenomenon.

Aside from our strenuous objections to the basic premise of the bill and the inequitable reduction formula, AMAX Coal Company would like to acknowledge your efforts to consider the human factors involved in this issue. Nevertheless, even with mandated technology for the targeted 50 plants, significant coal production will be lost in the Midwestern and Northern Appalachian high-sulfur, coal-producing areas. Additionally, not all of the "top 50" plants are likely candidates for retrofit due to either age or physical constraints. Given this reality, there would be little difference in the magnitude of job displacement resulting from H.R. 3400 or S. 768. (For a further discussion of retrofit eligibility, please see the Temple, Becker and Sloane study of H.R. 3400 made for the Edison Electric Institute, September 20, 1983.)

Should Congress decide that acid rain is a national problem of such proportion so as to warrant a reduction program, we firmly believe that the plan must include some type of cost-spreading mechanism. While AMAX Coal Company does not endorse any particular type of taxing or finance structure, it is clear to us that cost spreading, in some form, will be necessary if severe economic damage to the industrialized Midwest is to be avoided.

Lastly, AMAX Coal Company believes it would be contrary to the primary goals of the Nation and the Clean Air Act to statutorily freeze the advancement of innovative technologies. This would be the result of passage of this type acid rain control bill since utilities would be obliged to commit early on to a "proven" technology for compliance. Indiana has just dedicated a pilot project here in Indianapolis to test a new dry scrubber process. By combining ammonia and electron beams through post-combustion scrubbing, 90 percent of the sulfur dioxide and 90 percent of the nitrogen oxides will be removed. The by-product will be a commercially salable fertilizer. This holds great promise for the electric utility industry which generally views the present scrubber technology as being inefficient, expensive and the producer of a by-product which is difficult to work with, and unwieldly in its disposal. Even with complete sources and subsequent utility acceptance of this technology, it would not be "commercial" in time to be available for selection as a proven conpliance technology under H.R. 3400.

Despite the significant scientific uncertainty involved in the issue, we recognize that certain members of Congress may feel compelled to take immediate action on the acid rain issue. That being the case, we urge you to consider the following option as a productive, viable alternative to costly, high-risk reduction programs.

Implementation of a small scale live experiment involving innovative technology at a limited number of sites located nearest the sensitive areas of the country would allow development of a control program on the basis of actual results in contrast to development of a program based on disputed unproven theory. It would provide the needed encouragement for application of promising, yet unproven technology. And it would avoid the unnecessary and unsupportable economic damage of an industry and the economy entire region of the country.

AMAX Coal does not argue with the fact that there may be certain areas sensitive to acid deposition, and does not believe that the issue should be avoided. However, we believe that it would be unquestionably irresponsible to implement a program based on politics rather than fact. We appreciate your efforts and recognition that acid rain is a multi-dimensional issue, and ask that you not abandon your concern with the human and economic problems associated with the issue. We welcome this and any future possibilities for discussion and input on acid rain.

REPORT OF THE
AD HOC COMMITTEE
TO REVIEW THE
NATIONAL ACID PRECIPITATION
ASSESSMENT PROGRAM
(NAPAP)

United States Environmental Protection Agency
Science Advisory Board
Washington, D.C. 20460

December 1983

I. Executive Summary

This is the final report of the Ad Hoc Committee to Review the National Acid Precipitation Assessment Program (NAPAP). The Committee has met over a five-month period to review the activities of this important research effort with special emphasis on scientific quality, the scope of the research effort, adequacy of the research plan and its relevance to policy concerns, and research management.

The Review Committee is acutely aware of the need both to provide information to policy makers in the short run, and to accumulate knowledge over the long term which will provide improved understanding of the relationship between emissions and environmental effects. The Committee's recommendations are aimed at strengthening NAPAP's ability to meet both of these objectives.

The present NAPAP system has important strengths and weaknesses. On the one hand, the Review Committee was favorably impressed with the progress that NAPAP has made since its establishment in 1981, the manner in which the interagency process is working to coordinate research projects in the participating agencies and the scope of the present research effort.

On the other hand, the Committee has found several weaknesses in the program which should be repaired. First, insufficient resources are being provided to NAPAP given the enormous breadth and complexity of the technical issues involved. Moreover, the resources are allocated to the participating agencies in a manner which competes with declining agency research budgets and does not give part-time task group leaders authority over the technical program for which they are responsible. Second, the present decentralized interagency management process is not likely to be capable of undertaking several important functions: systematic integration of research results, management of large scale projects, and technical support for policy formulation. Third, insufficient multi-year, indepth studies of the atmospheric consequences of emissions and ecological effects of acid deposition on lakes and streams, watersheds, forests, soils, and biota are underway to provide an adequate basis for verifying "system" models which are needed to meet credibly the 1985 and 1987 NAPAP assessment milestones. Substantial additional resources will be required over time to answer important technical issues. Key areas requiring additional emphasis are integrated assessments, indepth studies of aquatic and terrestrial effects and verification of source-receptor models. Additional aspects of the NAPAP program which need strengthening are mentioned in the body of this report.

The report also notes some technical areas which need greater emphasis and resources. These include air monitoring, accelerated development of techniques for dry deposition monitoring, more precise determination of resources at risk, and attention to the relationship of acid deposition to other air pollution phenomena. The need for additional research on mitigation strategies is also noted as well as the need for a greatly expanded program on control technologies to be carried out by the Department of Energy (DOE) outside the NAPAP program.

The principal recommendations of the Review Committee address management changes, revised budgeting procedures, key areas requiring additional resources, and the need to improve the scope and quality of the basic science effort underlying the entire NAPAP effort. There should also be greater cooperation with foreign countries facing the acid deposition problem.

The recommended management changes involve the addition of a full-time Director of Assessment who would be an Assistant Administrator or Deputy Assistant Administrator of EPA. This individual would be the EPA representative on the Joint Chairs of the NAPAP Interagency Task Force, and he or she would be responsible for the functions of (1) technical support for policy development, (2) integration of research results and technical assessment, (3) broad research guidance to the NAPAP Research Coordination Council, and (4) the management of new, large scale projects. The existing NAPAP interagency process would be maintained to carry out the bulk of the research effort.

The principal budget recommendation concerns changing the manner in which resources are provided to agencies participating in NAPAP. Any additional funds allocated above the FY'84 budget levels should be provided as "new" money to the participating agencies. The Director of Research, task group leaders, and the proposed Director of Assessment must have control over the NAPAP approved research budgets for which they are responsible.

The Review Group believes that it is essential to strengthen and expand the fundamental science component of the NAPAP program. A standing, external scientific advisory committee for NAPAP is proposed and increased emphasis is recommended for publication of scientific results in the peer reviewed scientific literature to provide a mechanism for debate on controversial issues. A fundamental research effort is essential to clarify many questions about the environmental impact of acid rain. Therefore, the basic research must be protected from the budgetary demands of more short-term research efforts and larger projects. To insure broad participation by qualified scientists, an external research grant program, open primarily to industry and universities, should be established as a matter of high priority with an anticipated funding level of $10 million per year in new funds.

SANDRA EMMANUEL
INDIANAPOLIS URBAN LEAGUE
INDIANAPOLIS, INDIANA

THE INDIANAPOLIS URBAN LEAGUE IS A NON-PARTISAN, INTERRACIAL, NON-PROFIT COMMUNITY ORGANIZATION WHICH USES THE TOOLS AND METHODS OF SOCIAL WORK, ECONOMICS, LAW, BUSINESS MANAGEMENT AND OTHER DISCIPLINES TO SECURE EQUAL OPPORTUNITIES IN ALL SECTORS OF OUR SOCIETY FOR BLACK AMERICANS AND OTHER MINORITIES.

THE INDIANAPOLIS URBAN LEAGUE RECEIVES SUPPORT FROM THE UNITED WAY, FOUNDATIONS, UNIONS, CORPORATIONS, CHURCH GROUPS AND OTHER COMMUNITY ORGANIZATIONS AND INDIVIDUALS. SEVENTY-FIVE PERCENT OF OUR CLIENTS ARE RECIPIENTS OF MANY STATE AND FEDERALLY FUNDED PROGRAMS.

WE STRONGLY URGE YOU TO TAKE INTO CONSIDERATION THE FACT THAT INDIVIDUALS IN INDIANAPOLIS WHO UTILIZE STATE AND FEDERALLY FUNDED PROGRAMS WILL FIND THEMSELVES IN A SERIOUS FINANCIAL SITUATION IF THEIR ELECTRIC BILLS ARE INCREASED SUBSTANTIALLY BY ACID RAIN LEGISLATION.

THE POVERTY POPULATION LEVEL IN THE INDIANAPOLIS SMSA WAS APPROXIMATELY 107,000 IN 1980. THE NUMBER OF CHILDREN UNDER AGE 18 BELOW THE POVERTY LEVEL WAS APPROXIMATELY 40,000. THE POPULATION OF 65 YEARS OF AGE AND OLDER WHO HAD INCOMES BELOW POVERTY LEVEL NUMBERED 14,000 IN 1980. THESE INDIVIDUALS AND HOUSEHOLDS PAY ELECTRIC BILLS. THEY CANNOT AFFORD A 25 TO 35 PERCENT INCREASE IN ELECTRIC RATES.

WHILE THE ACID RAIN FUND IS PURPORTED TO PAY FOR ADDITIONAL ENVIRONMENTAL CONTROLS EQUIPMENT, WE ARE NOT NAIVE ENOUGH TO BELIEVE THE TAX ON UTILITY COMPANIES WON'T BE PASSED ON TO THE CONSUMER. IN ADDITION, OUR LOCAL ELECTRIC UTILITY WILL HAVE TO

PAY THE TAX, BUT PROBABLY NOT BENEFIT DUE TO THE LACK OF FUNDS AVAILABLE FOR THE ENTIRE PROGRAM. CONSEQUENTLY, A LARGE PORTION OF THEIR ACID RAIN COMPLIANCE COSTS WILL BE BORNE AGAIN BY THE CONSUMER.

THIS PROPOSED INCREASE IN ELECTRIC COST WOULD BE ON TOP OF PHONE COST INCREASE RESULTING FROM THE AT&T DIVESTITURE, AND CERTAIN INCREASES IN NATURAL GAS PRICES. THE INCREASES ARE GOING TO DISPROPORTIONALLY IMPACT ON THE POOR; UNEMPLOYED; AND ELDERLY PEOPLE WHO ARE ON FIXED INCOMES.

ACID RAIN MAY OR MAY NOT BE A PROBLEM, SCIENTIST OFFER WIDELY DIFFERING VIEWS ON THIS ISSUE, BUT BEFORE YOU ASK INDIANAPOLIS' UNEMPLOYED AND POOR TO HELP FOOT THE BILL, YOU MUST BE ABSOLUTELY SURE THAT IT IS A PROBLEM AND NOT JUST SPECULATION. THE INDIANAPOLIS URBAN LEAGUE WANTS A CLEAN ENVIRONMENT. IT SUPPORTS ADDITIONAL RESEARCH TO ANSWER THE QUESTIONS CONCERNING ACID RAIN THAT ARE STILL UNANSWERED BECAUSE WE MUST HAVE THE ANSWERS TO DEVELOP RATIONAL PUBLIC POLICY.

THANK YOU FOR ALLOWING THE INDIANAPOLIS URBAN LEAGUE TO TESTIFY TODAY.

February 9, 1984

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Holcomb Research Institute
Office of the Director

Congressman Henry A. Waxman
Chairman, Subcommittee on Health
and the Environment
2415 Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Waxman:

Please accept my regrets that I could not personally present oral testimony at your Committee's hearings on February 10 in Indianapolis. With this letter I want to summarize briefly the benefits I believe will accrue to Indiana and the Ohio Valley area from a substantial reduction of sulfur dioxide (SO_2) emissions in this region. I am attaching a manuscript that is being submitted to American Forests magazine and would like this letter and the manuscript to be incorporated as part of the hearing record.

The manuscript describes what I consider to be an epidemic of foliage damage and mortality among conifers in the urban areas of the Ohio Valley, and presents the evidence linking these effects to the high concentration of acid sulfate aerosols recorded in the region during the past 15-20 years.

My professional training was originally in Forestry and my doctorate is in botany. I have done research on the cycling of materials in watersheds and ecosystems for the past 15 years in Wisconsin and Indiana and have written close to 150 papers on forests, lakes and their chemical cycles. However, despite experience that could have suggested insights to me several years ago on how acid aerosols would affect plants, it was not until 1983 that I was able to formulate a credible hypothesis explaining the abnormal foliage, narrow growth rings and mortality being observed in central Indiana. As described in the attached paper, the explanation seems to be that the very low pH of the liquid sulfate aerosols deposited on foliage (at a pH of -0.6, or one million times more acid than the acid in rain), together with nitric acid and ozone damage, leads to leaching of nutrients from leaves in the patterns shown in the accompanying color illustrations. This explanation, while requiring much additional research, is being given considerable credence by colleagues from several southern and eastern states with whom I have discussed it.

Despite the seriousness of the damage described in the attached paper, I am fundamentally an optimist. I prefer to focus on how readily our air quality and biological resources could be improved with a moderate investment in sulfur and nitrogen oxide emission controls. There is no doubt that additional SO_2 emissions reductions will bring about sulfate aerosol abatement, as the SO_2 reductions of the past 10 years have shown partial sulfate control in Indiana. However, the downward trend in SO_4 has leveled off at concentrations comparable to those of the early 1970's when annual growth rings were already seriously depressed.

The additional reduction in sulfate will afford three important benefits to Indiana:

- Relief from the health effects now being shown (by Jack Winchester of Florida State University) from the concentrated sulfuric acid aerosols cited above (at concentrations of 40 micrograms per cubic meter in our region during sulfate events);
- The restoration of 10 to 20 mile summer visibility (from our present three to five mile visibility), which would afford a basis for building a recreational industry around the beautiful hills and reservoirs of southern Indiana. These, unfortunately, are now clearly visible only in late fall, winter and early spring, and cannot be photographed during the sulfate aerosol events of summer;
- Removal of the reputation of Indiana as an industrial "black smokestack" state so that industries favoring a clean-air environment will consider locating here.

For many reasons, I am obligated to considerable travel in my work. Inevitably, I compare the foliage condition of crops and forests, and the scenic qualities of landscapes from Minnesota to Florida, north and east to Maine. The condition of forests and crops should be viewed as used towe view the condition of canaries taken into coal mines. Of all the areas I see, the forests and crops of the Ohio Valley show the poorest condition and the greatest mortality. Thus, I believe additional research will show the greatest benefits also in this region, rather than in the northeast, as is commonly assumed. In my judgement, we can expect a balance of cost and benefits within the Ohio Valley region, but for Indiana to benefit, there must be emission controls in our upwind states -- Wisconsin, Missouri, Illinois, and Kentucky -- as well as in Indiana.

The fact that several studies have found the narrowing of tree-rings began in the mid to late 1960's throughout this region, and that certain species have begun an unusual level of mortality already, suggests that a very difficult choice is being made by all of us this year: if we choose to discount the evidence (strong, but unproven) explaining our forest decline, we risk more extensive mortality of still more species in the years ahead; if we discount these concerns as "premature", we risk the possibility of unneeded increases in electricity costs. For many reasons, the latter is the lesser risk.

In Indiana, we have a tradition of "pay as you go," avoiding having the state borrow from anyone. The apparent long-term growth reductions in our forests represents a borrowing, however. It is an infringement on the productivity of resources that our children should enjoy. In my own relationships with my children, I go an extra mile to remove any perception that I am borrowing from or burdening them, even when that perception may be doubtful. I hope it will be possible for you and the Congress to view abatement of sulfur dioxide emissions in the Ohio Valley in that light, and to avoid even the perception that your generation and mine does not pay its own way.

Sincerely yours,

Orie L. Loucks
Director

FOLIAGE COLOR: WHAT DOES IT MEAN?

by Orie L. Loucks*

After nearly 50 years of observing tree foliage as it is influenced by the seasons, the aging process, and the regeneration pattern of each species, one might expect to have seen all that the forest can show. Indeed, many people sense security and dependability in each spring's return of foliage and flowers and in the unfolding of bright colors in the fall. The very antiquity of individual trees five times older than most people expect to live gives one a sense of continuity with nature and a historical perspective.

But these truths seem not to hold in the Ohio Valley where I have seen and photographed damaged foliage and premature mortality in both deciduous and coniferous species since 1978. Indeed, the yellowed condition (*chlorosis*) of foliage in summer, the dampening of fall colors, and the early decline of otherwise long-lived species lead, not to a sense of security from knowing the forest, but to anguish over how much has changed and how insecure may be the future of these species.

My notes and photographs of the rich greens and deep blue-green of the eastern forest species began in a formal sense 30 years ago while studying the vegetation of the Boundary Waters Canoe Area in northern Minnesota. Since then I have worked or visited from Maine to Alaska and Hawaii, and from Newfoundland to the Yukon in Canada. I saw little that was disturbing until I came in 1978 to the Ohio Valley on a year-round basis. What I found here is recorded in the photographs accompanying this article: the yellow-green rather than blue-green foliage of white pine (*Pinus strobus*); the chlorosis and gradual thinning of foliage on tulip poplar (*Liriodendron tulipifera*); the July and

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*Director, Holcomb Research Institute, Butler University, Indianapolis, IN. *Photographs by author.*

August leaf-fall of sycamore (*Platanus occidentalis*), white ash (*Fraxinus americana*) and the hickories (*Carya* spp.); the discolored and misshapen leaf lobes on maples (*Acer* spp.); the yellow and yellow-brown midsummer foliage on black oak (*Quercus velutina*); the premature fall senescence and muting of fall colors; and, worst of all, the unusually high frequency of mortality of the trees in our city parks and residential hedgerows.

What makes these observations particularly worrisome is the similarity (considering important species differences) between the effects in the Ohio Valley and those being reported as part of the deterioration of forests in Germany. Many aspects of the detoriation there suggest a linkage, with an undetermined latency, to increased concentrations of several air pollutants, including the deposition of acidic substances in rain over the past several decades. In this paper I will compare the symptoms I see in the forests of the Ohio Valley with those reported in Germany, examine the possibility of a relationship between the symptoms and the pollutant concentrations of this region, and consider the further studies needed to evaluate the significance of these phenomena for U.S. forest resource protection policy.

The first reports of widespread foliage thinning, followed by individual tree mortality, are those of Ulrich and others[1] reporting on research in the Harz Mountains of central Germany. They showed evidence linking these effects to the regional deposition of acidic substances. Work at their sites is continuing to suggest a connection among the excess sulfate and nitrate received in the rain and snow, the resulting excess acidity in the soil, the release of toxic levels of dissolved aluminum in the soil, followed by root uptake, induced drought symptoms known to be representative of aluminum toxicity. Substantially similar symptoms have been observed by Vogelmann[2] in the Green Mountains of Vermont, but there are also differences between Germany and Vermont in the way the effects are expressed. [The species involved are Norway spruce (*Picea abies*) in one case, and red spruce (*P. rubens*) in the other]. These differences have raised questions as to whether a similar explanation holds for both situations.

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[1] Ulrich, B., R. Mayer, and P.K. Khanna. Chemical changes due to acid precipitation in a loess-derived soil in central Europe. Soil Sci. 130: 193-199; 1980.

[2] Vogelmann, H.W., Catastrophe on Camels Hump. Nat. Hist. 91(11)8-14; 1982

The broad variety of forest decline symptoms in Germany was presented at a 1983 conference in Germany sponsored by the Aspen Institute Berlin. Dr. Ellis Cowling[3] has summarized the results: in addition to the apparent effect on roots of spruce in the Harz Mountains, other symptoms include thinning of foliage density, departures from normal foliage color, altered morphology of the leaves (including misshapen leaves on some species), and the casting of green foliage from some species during the summertime. In certain affected species, a marked deficiency of magnesium in the foliage is observed. The conference participants also noted the rapid expression of symptoms since 1979 (although the causes may trace back 10 to 20 years); the occurrence of symptoms on many species of forest trees; occurrence in planted forests as well as naturally regenerated forests, and on fertile as well as infertile soils, both basic and acidic. And, although the symptoms often were reported for forests at relatively high elevations, essentially similar symptoms have been observed at intermediate and low elevations.

This pattern of effects has led scientists investigating these phenomena to four hypotheses with the potential to explain part or all of the observed symptoms:[3]

(1) the *gaseous pollutant hypothesis*, that the forest symptoms are mainly the result of two well-known pollutants (ozone and sulfur dioxide) acting either alone or in combination;

(2) the *magnesium-deficiency hypothesis*, that an extreme magnesium deficiency has been induced in the presence of relatively abundant supplies of nitrogen (possibly the result of increased nitrogen in acidic rainfall);

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[3] Cowling, E.B., Report on Travel and Observations of Forest Decline in West Germany, September 15-21, 1983. Internal report, North Carolina State University.

(3) the *general stress hypothesis*, that the symptoms result from an alteration of gas exchange rates to and from the foliage, in altered growth hormones, and in the production of secondary metabolites, some of which are less mobile and produce a low-level toxicity; this hypothesis also leads to the proposition that a poor carbohydrate-energy status in roots and the decline of root/fungal relationships are but two in a series of responses to altered gaseous uptake, leading to an increased susceptibility of the trees to other stress factors such as drought, nutrient deficiency, and secondary insect and disease problems; and

(4) the *acidification/aluminum toxicity hypothesis*, in that the natural acidification of forest soils is thought to have been accelerated as a direct (or indirect) result of the deposition of acidifying substances; the acidification leads to higher concentrations of dissolved aluminum which, in turn, accelerates the loss of fine feeder roots and the uptake of water and nutrients to the whole tree.

While all of these hypotheses require further testing, evidence is continuing to suggest that they are not mutually exclusive and that all may hold in varying degrees. The extent to which these hypotheses hold in one region or another in the United States, or may explain the foliage condition described here, has yet to be examined carefully.

Of course, one needs to ask what significance is there in foliage discoloration? Are there not dozens of reasons, ranging from local nutrient imbalances to insect and disease attack that could explain discolored foliage? Indeed there are, but these effects should be widely distributed through the eastern broadleaf forest. However, I have compared foliage condition in Indianapolis and southern Indiana with what I have seen while visiting New York City, New England cities and towns, and Detroit, Toronto and surrounding areas, and the Minneapolis and northeastern Minnesota area. I find a surprising contrast: even in the large cities of the northeast, long-recognized as having common air pollution problems, deciduous and coniferous foliage, while having some symptoms, shows no where near the impaired condition that one sees in comparable urban and suburban areas of the Ohio Valley.

One may want to ask, also, whether the discoloration being observed is not simply a phenomenon of the city environment. Why should the symptoms being seen primarily in the cities be viewed as a problem of the region? Fortunately, the chlorotic foliage illustrated here is not quite as serious in the rural areas of Indiana as it is in the urban environment of Indianapolis, or mortality would be much more extensive than it is at this time. However, many of the symptoms described here are seen in milder form on open-grown trees in rural areas.

This pattern was confirmed by a study in Indiana four years ago. Usher and Williams[4] obtained data on the condition of white pine foliage during 1979 and 1980 at several sites ranging from rural to urban in Indiana, and at four rural locations in Wisconsin. From these data they produced a comprehensive *disease index* for white pine. The study showed that areas known to have elevated air pollutant concentrations (i.e., the Indianapolis metropolitan area) produce the most severely diseased foliage. As the pollutant load ameliorates in rural areas of Indiana (away from major power plants), and then to rural areas of central Wisconsin, foliage condition improves considerably. However, even the rural Wisconsin sites show the presence of mild air pollution symptoms on the foliage of some trees. The tendency for reduced foliage quality to produce a narrowing of tree rings and mortality in the vicinity of gaseous pollutant sources has been well documented.[5] Indeed, the narrow rings illustrated in the accompanying photographs, began at the same time (late 1960's) that Altshuler[6] has shown acidic pollutants began to be recorded at recognizably elevated levels in the Midwest.

Let me also observe that a variety of agents, operating on individual trees or in whole stands, can produce some of the symptoms observed here.

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[4] Usher, Roland W. and Wayne T. Williams. Air pollution toxicity to Eastern white pine in Indiana and Wisconsin. Plant Dis. 66(3):199-204; 1982.

[5] Skelly, J.M., S. Duchelle, and L.W. Kress. Impact of photochemical oxidant to white pine in the Shenandoah, Blue Ridge Parkway, and Great Smoky Mountain National Park. In: Second Conference on Scientific Research in the National Parks. American Institute of Biological Sciences and National Park Service [not available for checking]; 1979: p. 131.

[6] Altshuller, A.P. Seasonal and episodic trends in sulfate concentrations (1963-1978) in the eastern United States. Env. Sci. and Tech. 14(11):1337-1349; 1980.

Nutrient deficiencies are an example, and these can be an interactive consequence of drought stress in urban environments (often due to the compacted soil along streets or in lawns). In addition, mortality following attack by various insects and pathogens can be a frequent occurrence, not a rare occurrence, in trees of the urban environment. However, these attacks are all favored by the stresses induced from pollutants, and attack frequency, like foliage condition, can be thought of as a pollution-induced response.

Finally, one also has to consider the evidence becoming available of widespread narrowing of the annual growth rings of trees in the Ohio Valley and eastern U.S. Results being reported from ongoing studies in much of the eastern U.S. show that an appreciable narrowing of rings has taken place in a number of species over the past 20 to 25 years. These studies focus heavily on the areas in which acidic deposition may have affected water resources; that is, the Appalachian Mountains, Pennsylvania and the Northeast, but few sites confirm the same effect in the Ohio Valley.

At the same time, studies such as those of Johnson and colleagues[7] have found that the pattern of decline in tree-ring widths shows a relatively strong correlation with fluctuations in the pH of rainfall. They also found a strong interaction among ring-width, rainfall pH and drought stress, suggesting that during periods of drought there is an even greater effect from the pH influence. This response is consistent with aluminum toxicity and its tendency to induce drought symptoms but, despite these correlations, Johnson and others have not yet concluded that the observed effects have been proven to be the result of acidity in rainfall.

An inevitable question is whether there is evidence that the mechanisms being suggested to explain effects in the forests of Germany also could account for what is being observed in the Ohio Valley. Several studies have documented the large quantities of sulfur dioxide released to the atmosphere along the Ohio River corridor, similar to or greater than the large local sources in west-central Germany. The states of Missouri, Illinois, Kentucky, Indiana, Ohio and West Virginia all have major coal resources (with a relatively high concentration of sulfur), and all have abundant water supplies for cooling the large coal combustion systems. The result is locally high concentrations of combustion gases (sulfur and nitrogen oxides) and their transformation products, sulfate aerosol and ozone.

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[7] Johnson, A.H., T.G. Siccama, D. Wang, R.S. Turner, and T.H. Barringer. Recent changes in patterns of tree growth rate in the New Jersey pinelands: a possible effect of acid rain. J. Environ. Qual. 10(4): 427-430; 1981.

Other studies have demonstrated that the sulfate is formed from the available sulfur dioxide at a sustained rate of 1 to 4 percent per hour. The resulting sulfate then is balanced either with H^+ (from water, forming concentrated sulfuric acid in liquid aerosol particles), or in the form of ammonium bisulfate particles. Aerosol monitoring in the Ohio Valley shows the strongly elevated concentrations of sulfate along a corridor extending 100 miles or more on each side of the river from Illinois to central Pennsylvania. The relatively high levels, whether taken as mean annual averages (shown in the accompanying figure), or as peak observations during elevated sulfate episodes, are twice as high as the values in other regions of the eastern United States where acidic deposition in rainfall is viewed as a problem.

The loss of visibility in the Ohio Valley corridor also has been established as the result of the high sulfate aerosol concentration. Scattering of light by sulfate aerosol particles comes from their capacity to take up hygroscopic water, become enlarged, and thereby intercept and reflect light in the lower atmosphere. Visibility attenuation has been investigated in the Midwest since 1950 and the decline follows closely the increase in sulfur dioxide emissions during the late 1960's, the same period that tree rings became narrower. Sulfur emissions have been ameliorated somewhat by partial control measures during the past 10 years; but, despite the resulting decline in sulfate concentration from its peak years, a profound reduction in visibility along the high sulfate corridor is evident from recent data, as well as in the scenes shown with this article.

The high sulfate aerosol concentration, due to its uptake of water, also produces a predisposition to more frequent summertime ground fog. Representative measurements of the pH of fog and clouds in several areas of the United

States show these aerosols to be producing acidity in the range of pH 2.5 to 3.5, over 10 times more acid than the acid rain in the same areas.

A region of high sulfate aerosol concentration is also a region with relatively high rates of dry deposition of acid aerosol particles onto foliage surfaces. Here, the acidity can be mobilized almost every night during the formation of dew. The dissolution of the sulfate aerosols into hydrogen ions, ammonium and sulfate during dew formation has been considered in relation to what the daily deposition is, and, in the absence of neutralizing substances from the foliage, the pH of the dew in these circumstances is determined by the total deposition (since the last cleansing rain) and the amount of dew-water diluting it. With a minimal wetting, the expected pH (without neutralization from the leaves) is on the order of 2.2 (for high sulfate deposition rates), or roughly *100 times* more acid than the rainfall (at pH 4.2) in much of the Ohio Valley region.

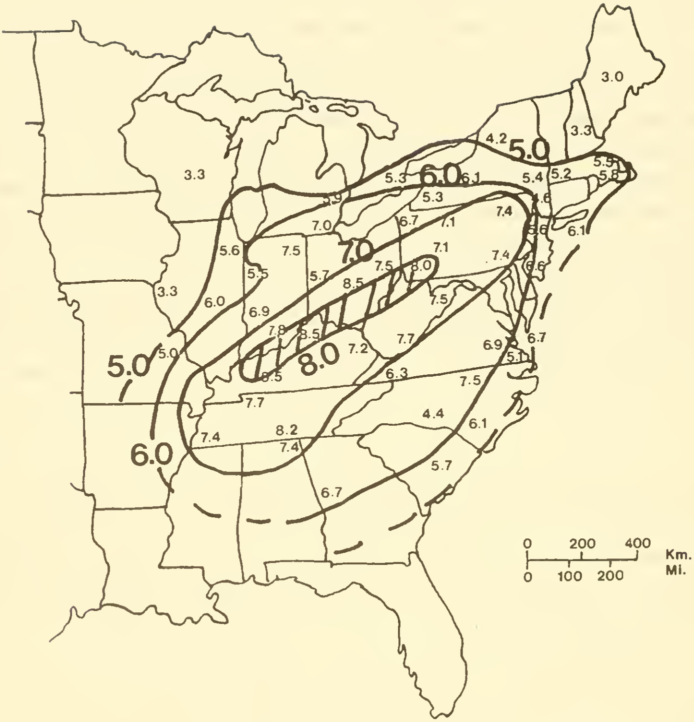
Studies of the effects of acidic deposition (wet and dry) on foliage have shown erosion of the waxy surfaces of leaves to be a major response. An associated effect is easier penetration of certain pathogens through the surface tissue of leaves. What has not been investigated, however, is the extent to which the partial removal of waxes, and the presence of the strong acid in the form of dew, allow for more rapid leaching of the bases (nutrients) required for normal photosynthesis. These bases include calcium, magnesium, sodium and potassium, all of which are leached to some degree by natural rainfall. However, the rate at which the leaching would be increased by relatively strong acid on the leaf surfaces is not known.

In addition to the dry deposition and the concentrated acidity produced by the dew, the affected plants are functioning in an environment with relatively high concentrations of another toxic gas, ozone. The symptoms associated with this pollutant are observed regularly in the Ohio Valley region, particularly on cucumber and melons, but also on tulip poplar and sweet gum (*Liquidambar styraciflua*). Despite the well-known pattern of ozone damage on crops, the potential also exists for acid dew and fog to operate on crop and tree foliage, and the combined toxicity should be evaluated.

Obviously, the evidence available to date does not provide proof, or even a test, of the hypothesis that acidic substances in dew and fog produce the unusual foliage condition and the narrowing of growth rings now being seen in the Ohio Valley. However, the symptoms are not so pronounced outside the high sulfate corridor, and a full explanation will have to take into account the unusual regional distribution of the damage. For the present, the observations can do little more than to formalize the hypothesis that aerosol acidity in dew and fog, together with what is known of how this particulate acidity can affect foliage, may be sufficient to explain the leaf symptoms, the decreased annual growth ring, and the mortality of open-grown trees of certain species. Undoubtedly, the effects of acidity operate interactively with other known pollutants in the region, and the wide variability in responses is consistent with genetic variability within and among the species.

What is the significance of this remarkable series of foliage damage symptoms? The answer is unclear but, until very recently, few people were willing to consider the possibility that the problem of air quality in the industrial heartland of the United States has broad regional effects on natural resources. Despite the absence of definitive (and long-term) studies of the questions being raised here, the methods now available for examining best courses of action under uncertainty, and with major resources at risk, should be brought to bear on the forest growth responses described.

Conventional wisdom holds that cheap electricity fosters employment in the Midwest. The price of this employment, however, may be the lost visibility, the foliage effects and the reduced growth that are becoming linked to combustion wastes released to the atmosphere. Clearly, the tree-ring record tells us that these impacts were first expressed over a large area in the late 1960's and that 15 years elapsed before substantial mortality was observed. At this point, it seems that we should draw on the experience we have to consider what risks lie ahead if remedial actions are not begun soon. The forests, because they are so long-lived, are also endowed with a long memory through their annual growth rings. When future generations assemble the tree-ring record for the last decades of the 20th century, the story to be told will be about a society and its relationship to natural resources. The opportunity still remains for timely actions which could make that record reflect favorably on us.



Monitoring of the concentration of sulfate aerosols (in micrograms per cubic meter), averaged over a full year, show a corridor of unusually high values centered along the Ohio Valley.

STAFF MEMO

Staff Memorandum

prepared by the

OTA Oceans and Environment Program

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An Analysis of the Sikorski/Waxman Acid Rain Control Proposal: H.R. 3400, "The National Acid Deposition Control Act of 1983"

This OTA Staff Memorandum has
neither been reviewed nor approved
by the Technology Assessment Board

ANALYSIS OF H.R. 3400, "The NATIONAL ACID DEPOSITION CONTROL ACT OF 1983"

I. H.R. 3400, The Sikorski/Waxman Acid Rain Control Proposal

The Office of Technology Assessment (OTA) was asked by Congressman Waxman, Chairman of the House Subcommittee on Health and the Environment, to analyze the costs and potential coal market shifts of an acid rain control proposal (the Sikorski/Waxman proposal) being considered by several members of the Subcommittee. The proposal was introduced June 23, 1983, as H.R. 3400. OTA analyzed those provisions of the bill that address sulfur dioxide emissions. The analysis is based on data and models used for OTA's ongoing assessment, "The Regional Implications of Transported Air Pollutants," scheduled for completion later this year. Technical support was provided on contract to OTA by E. H. Pechan and Associates, Inc.

As we understand H.R. 3400, the major provisions include:

- Eliminating 10 million tons of sulfur dioxide emissions in the continental 48 states by 1993. Reductions per state are determined by a formula based on utility emissions during 1980.[1]

- A requirement that 50 specified utility plants reduce sulfur dioxide emissions by using technology that removes a specified percentage of potential sulfur dioxide emissions.[2] According to this requirement, 50 plants in 14 states would be required to install flue-gas desulfurization technology (i.e., scrubbers) by 1990.

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[1] The amount by which a state must reduce its sulfur dioxide emissions is determined by the following formula: Calculate the difference between a state's 1980 utility emissions and the emissions that would result if no electric-generating plant in that state emitted sulfur dioxide at a rate greater than 1.2 pounds per million Btus. Repeat this calculation for the continental 48 states as a whole. The state's proportion of the total regional difference, multiplied by 10 million tons, is the amount of sulfur dioxide emissions that must be eliminated in that particular state. Though H.R. 3400 can be interpreted differently, OTA has been assured by the Subcommittee that this is the intended allocation formula. Potential emissions increases from new utility and non-utility sources, as well as increases in emissions from increased use of existing sources, appear to be allowed under the proposal.

- Establishing a trust fund through a new 1 mill (one-tenth cent) per kilowatt-hour tax on non-nuclear electricity generation. The trust fund would be used to reimburse utilities for 90 percent of the capital costs of installing pollution control technology on the 50 specified plants. Any remaining funds could be used to pay part of the costs of pollution control technology installed on other than the 50 specified plants, at the discretion of the Administrator of EPA. The tax begins in 1985 and expires by 1996 or after sufficient funds have been raised to reimburse allowable control costs.

II. Emissions Reductions Specified by H.R. 3400

A. State-level Reduction Requirements

H.R. 3400 requires eliminating 10 million tons of sulfur dioxide emissions in the 48 states, or about 38 percent of estimated 1980 emissions. This shall be achieved by January 1, 1993. Table 1 presents the sulfur dioxide emissions reductions by state, as allocated by the proposal.

The first column shows 1980 utility emissions by state, while the second column displays the reductions from 1980 sulfur dioxide emissions required by the proposal. However, it is important to note that under current laws and regulations embodied in State Implementation Plans (SIPs), some states are presently required to decrease their sulfur dioxide emissions. Approximately 1.4 tons of the 10 million ton reduction specified by the proposal is already required under existing SIPs.[3] Column 3 shows the reductions in emissions required by the proposal beyond those needed to comply with the provisions of existing laws and regulations.

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[2] The plants required to install pollution control technology are the 50 plants that emitted the greatest tonnage of sulfur dioxide emissions in 1980, chosen from those plants that emitted sulfur dioxide at a rate equal to or greater than 3 pounds/million Btu. The control technology must remove between 70 and 90 percent of potential sulfur dioxide emissions, depending on emission rate.

The fourth column shows final utility emissions as if the reductions had been achieved in 1980 from utilities only. Therefore, increases or decreases in sulfur dioxide emissions through the 1980s and 1990s are not included in this final emission column, nor are potential emissions reductions from non-utility sources. The final two columns illustrate the required reductions as a percentage below 1980 utility and total man-made sulfur dioxide emissions, respectively.

B. Control Technology Requirements

H.R. 3400 requires adding sulfur dioxide emissions control technology to fifty utility plants by January 1, 1990. Table 2 displays 80 utility plants that emitted the greatest tonnage of sulfur dioxide during 1980. The "top 50" plants that emitted sulfur dioxide at a rate equal to or greater than 3.0 pounds/million Btu of fuel burned are marked with a circle. Because several plants emit at rates quite close to the specified limit, the list is subject to some uncertainty.

Table 3 displays the distribution of these plants by state. The "top 50" plants, located in 14 states, emit about 44 percent of utility, and about 28 percent of total sulfur dioxide emissions nationwide. Of the total emissions reductions required by H.R. 3400, about two-thirds would come from these "top 50" plants. The last column displays the required percent reduction in sulfur dioxide emissions for the "top 50" plants specified by the proposal, assuming thse plants continue to burn their current fuel.

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[3] This estimate is derived from the latest SIP list available from EPA; however, OTA is aware that some inaccuracies exist.

C. Future Emissions

H.R. 3400 does not require offsetting emissions growth from new sources, or increased use of existing sources. Table 4 presents a range of projections of sulfur dioxide emissions through the year 2010, for both the U.S. and the Eastern 31-state region.

As can be seen from the table, the greatest rates of increase are projected for industrial sources, whose emissions grow by about 2 to 3 million tons by 2000. These projections assume that rising oil and natural gas prices will cause many current users of these cleaner fuels to switch to coal.

Nationwide utility emissions are projected to increase by about 0.6 to 2.2 million tons by 2000 (with one projection, based on very high assumed growth rates, over 4 million tons). Eastern utility emissions are projected to range from a 1 million ton decrease to as high as a 2 to 3 million ton increase by 2000. However, if H.R. 3400 were to become law, changes from emissions levels after reductions were achieved would not be as great as those shown in the table. A portion of the emissions growth is due to increased use of existing utility plants to meet increased electricity demand; because the rate of emissions (i.e., sulfur dioxide per quantity of electricity generated) would be lower, emissions changes would also decrease.

III. Costs of H.R. 3400

We have estimated the cost of the bill for each of three phases:[4]

- Phase 1: On January 1, 1985, a 1 mill/kilowatt-hour non-nuclear electricity tax is imposed to pay for 90 percent of the capital cost of control technology required for the "top 50" plants. This phase extends until emissions reductions are achieved (1990 through 1993) or the trust fund raised by the tax acquires sufficient capital. We estimate the costs to be about $2.0 billion/yr. (1982 dollars) -- the annual contribution to the trust fund. We estimate that about $12.6 billion dollars must be raised for the trust fund for the "top fifty" plants. Additional funds might be desired to pay for control technology installed on other plants.

- Phase 2: There will be a period of time when consumer costs will include both the 1 mill/kilowatt-hour tax and the costs of emission controls. This phase will end when either sufficient capital has been raised or by January 1, 1996, whichever comes first. We estimate the costs during this period to be about $4.5 to $5.2 billion/yr. (1982 dollars). The average electricity rate increase for residential consumers should be about 3.2 to 3.7 percent, ranging from a low of under 1 percent to a high of about 10 percent in individual states.

- Phase 3: After the tax expires, consumers will pay the costs of emission controls until the 1980-existing plants are retired.

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[4] Costs have been estimated using the AIRCOST model, developed and run by E. H. Pechan and Associates, Inc.

However, 90 percent of the capital costs of control technology installed on the "top 50" plants will have been paid from the trust fund raised during the first two phases. We estimate the costs during this phase of the program to be about $2.4 to $3.2 billion/yr. (1982 dollars). Average residential electricity rate increases should be about 1.7 to 2.3 percent, ranging from no increase to a high of about 8 percent in individual states.

The regional costs of the program are summarized in Table 5. Costs are also expressed in 1980 dollars for comparison to previous OTA analyses of acid rain control proposals. Table 6 presents average residential rate increases by state for each of these three phases (columns 1, 2, and 3; respectively). The estimates do not include reimbursement of capital costs for control technology installed on plants not on the "top 50" list. If some of these costs are paid by the trust fund, the costs during phase 2 and phase 3 might be lower, but phase 2 will last longer.

In addition, Tables 5 and 6 present cost analyses for two slightly different proposals. The same program (i.e., eliminating 10 million tons of sulfur dioxide emissions and requiring scrubbers on the "top 50" plants) but without the tax and subsequent trust fund to pay for capital, would cost about $4.5 to $5.3 billion/yr. Five states might experience residential rate increases exceeding 10 percent, with a high of 16 percent.

A program achieving similar emissions reductions but without the "top 50" plant technology requirement is estimated to cost about $2.9 to $4.0 billion per year. Average residential electricity rate increases are estimated to range by state from no increase to about a 11 percent increase.

IV. Potential Coal Production Changes

Switching from high- to low-sulfur coal is one of the major options available for achieving substantial sulfur dioxide emissions reductions. Consequently, emissions reduction programs create the risk of significant coal-market shifts by increasing the demand for low-sulfur coals at the expense of high-sulfur coals. Risks of production and consequent employment losses occur almost exclusively in the eastern U.S., where coal reserves of high-sulfur content are located.

Table 7(A) presents 1980 utility coal production by region and by potential sulfur dioxide emissions (as pounds/million Btu). Of the 533 million tons of utility coal mined in 1980, about 200 million tons (38 percent) had a sulfur content higher than 3.0 pounds sulfur dioxide/million Btu.

Table 7(B) presents the coal consumed by the "top 50" plants required to install control technology. As shown in Table 7(C), these plants consume about 25 percent of the total national utility coal production, and about 32 percent and 44 percent of utility coal production in Appalachia and the Central coal region, respectively.

As we understand H. R. 3400, one of the goals is to achieve emissions reductions without substantially dislocating existing coal production. By requiring the use of control technology on the "top 50" plants, the proposal makes fuel switching to achieve emissions reductions economically less attractive. About 90 percent of the coal used by these plants has a sulfur content greater than 3.0 pounds sulfur dioxide/million Btu. These plants consume about 60 percent of the utility coal of this sulfur content mined nationwide. Any future fuel switching that might occur by these plants would probably not be related to the installation of control technology mandated by the proposal.

Table 8(A) presents model-based estimates of the extent of coal production displacement if the provisions of H.R. 3400 had been in effect during 1980. We use this as a surrogate for changes in production due to the proposal as compared to mid-1990's production without emissions reductions. These estimates apply to coal production for utilities existing in 1980 only; production increases to supply new utilities are not included.

For these currently operating utilities, we estimate that the proposal might result in about an 11 percent and 14 percent increase in low- and medium-sulfur coal production, respectively. For high-sulfur coal (coal emitting greater than 3.0 pounds sulfur dioxide/million Btu), we estimate about a 9 percent decline (18 million tons) in existing-utility coal use. Regionally, this production would shift from high-sulfur coal fields in the Appalachian and Central states to western low-sulfur and eastern medium-sulfur coal fields.[5]

However, total high-sulfur coal production by 1995 will depend on demand from both currently operating and new plants. A recent study prepared for EPA[6] projects about a 22 percent increase in utility high-sulfur coal use between 1985 to 1995, in large part to supply utility plants to be built through the decade. Therefore, while H.R. 3400 would probably displace some high-sulfur coal production for currently-operating utilities, by the mid-1990s demand from new utilities might be expected to keep total high-sulfur coal production from dropping below 1980 levels.

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[5] Due to the competitive nature of the coal industry, we do not feel confident predicting the precise location of coal production shifts. For example, our model estimates that Central high-sulfur coal is slightly less expensive than similar Appalachian coals; however, the price differential is not great enough to assume that this will still be the case by the 1990s. In addition, we estimate that eastern low-sulfur coal is less costly than comparable western coals. Future changes in rail transportation rate might reduce the competitive advantage of western coals.

[6] ICF, Incorporated, February 1983, "Analysis of a Senate Emission Reduction Bill (S-3041)." Report prepared for EPA.

Each million tons of current high-sulfur coal production lost results in job losses for about 255 coal miners[7] (or about 350 total coal-mining industry employees[8]). These, of course, would be accompanied by job increases in low- and medium-sulfur coal producing regions. Production in these regions is expected to increase by the mid-1990s with or without the bill.

For comparison, Table 8(B) illustrates model-based estimates of coal production shifts that might occur under a control program similar to H.R. 3400, but without requiring the installation of control technology on the "top fifty" plants. We estimate that such a proposal would result in about a 25 percent increase in both low- and medium-sulfur coal production for currently operating utilities. We estimate about 25 percent decline (51 million tons) in existing-utility high-sulfur coal use under this scenario. Again, demand for coal from new utilities might offset some of this loss, but total high-sulfur coal production would probably drop below 1980 levels.

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[7] U.S. Department of Energy, March 1982, "Costs to Reduce Sulfur Dioxide Emissions."

[8] United Mine Workers of America, June 1983, "Employment Impacts of Acid Rain."

Table 1

EMISSIONS REDUCTIONS REQUIRED BY THE SIKORSKI/WAXMAN PROPOSAL

(Utility sulfur dioxide emissions/reductions, in 1000 tons/yr, assuming all reductions are achieved by utility sources only)

STATE	BASE EMIS.	INIT REDUC	REDUC AFT CR	FINAL EMIS.	PERCENT BELOW BASE	TOTAL
Alabama	543.1	281.0	232.9	262.1	51.7	37.0
Arizona	87.5	0.0	0.0	87.5	0.0	0.0
Arkansas	26.5	0.6	0.0	17.0	35.8	9.4
California	77.9	0.0	0.0	77.9	0.0	0.0
Colorado	77.5	0.3	0.3	77.2	0.4	0.2
Connecticut	32.0	0.0	0.0	31.8	0.6	0.3
Delaware	52.5	16.6	0.0	29.0	44.7	21.4
District of Columbia	4.6	0.0	0.0	4.6	0.0	0.0
Florida	725.9	334.2	333.3	391.7	46.0	30.5
Georgia	736.7	453.7	453.7	283.0	61.6	54.0
Idaho	0.0	0.0	0.0	0.0	0.0	0.0
Illinois	1125.6	753.2	709.8	372.4	66.9	51.2
Indiana	1539.6	1172.0	1129.3	367.6	76.1	58.4
Iowa	231.3	125.8	125.8	105.5	54.4	38.3
Kansas	150.1	74.7	34.9	75.4	49.8	33.5
Kentucky	1007.5	708.4	410.7	299.2	70.3	63.2
Louisiana	24.8	0.0	0.0	24.8	0.0	0.0
Maine	16.3	2.7	2.7	13.6	16.4	2.8
Maryland	223.2	107.7	98.0	115.4	48.3	31.9
Massachusetts	275.6	104.3	47.6	171.3	37.8	30.3
Michigan	565.3	233.3	226.5	332.0	41.3	25.7
Minnesota	177.3	63.3	63.3	114.0	35.7	24.3
Mississippi	129.2	71.9	71.9	57.3	55.6	25.2
Missouri	1140.5	894.7	894.7	245.8	78.4	68.7
Montana	23.4	1.5	1.5	21.9	6.6	0.9
Nebraska	49.4	7.5	7.5	42.0	15.1	10.0
Nevada	39.5	0.0	0.0	39.5	0.0	0.0
New Hampshire	80.5	49.4	46.3	31.1	61.4	53.2
New Jersey	110.2	37.4	37.4	72.8	34.0	13.4
New Mexico	84.6	0.0	0.0	66.0	22.0	6.9
New York	480.3	222.1	217.0	258.2	46.2	23.5
North Carolina	435.4	86.8	86.8	348.6	19.9	14.4
North Dakota	82.5	11.6	11.6	70.8	14.1	10.9
Ohio	2171.6	1589.7	1409.4	581.9	73.2	60.1
Oklahoma	37.7	0.0	0.0	37.7	0.0	0.0
Oregon	3.3	0.0	0.0	3.3	0.0	0.0
Pennsylvania	1466.1	846.3	679.6	619.8	57.7	41.8
Rhode Island	5.2	0.0	0.0	5.2	0.0	0.0
South Carolina	213.1	94.2	94.2	118.8	44.2	28.9
South Dakota	28.5	8.9	8.9	19.7	31.2	22.7
Tennessee	933.7	666.1	302.9	267.5	71.3	61.9
Texas	302.7	11.7	11.7	291.1	3.9	0.9
Utah	22.1	0.0	0.0	22.1	0.0	0.0
Vermont	0.5	0.0	0.0	0.5	4.8	0.4
Virginia	163.7	25.9	21.8	137.7	15.8	7.2
Washington	69.3	21.6	0.0	42.1	39.2	10.0
West Virginia	944.2	571.4	571.4	372.9	60.5	52.5
Wisconsin	485.7	342.6	342.6	143.1	70.5	53.7
Wyoming	120.8	7.3	0.0	70.2	41.9	28.3
Regional Total	17324.5	10000.6	8686.2	7240.5	58.2	38.1

Table 2. Highest Sulfur Dioxide Emitting Utility Plants
("Top Fifty" Utility Plants Marked With "●")

1980 SO_2 Rank	Plant Name	State	SO_2 Emissions (1000 tons)	SO_2 Emission Rate (lbs/MMBtu)
● 1	Gavin	Ohio	376.4	5.1
● 2	Cumberland	Tennessee	356.8	6.5
● 3	Paradise	Kentucky	342.7	6.8
● 4	Gibson Station	Indiana	305.6	4.9
● 5	Clifty Creek	Indiana	288.2	6.4
● 6	Baldwin	Illinois	259.3	5.2
7	Bowen	Georgia	248.1	2.8
● 8	Muskingum	Ohio	244.0	7.7
● 9	Labadie	Missouri	237.2	4.2
10	Monroe	Michigan	233.9	2.9
● 11	Harrison	West Virgina	215.0	4.0
● 12	Wansley	Georgia	209.8	3.7
● 13	Kincaid	Illinois	205.5	6.5
● 14	Conemaugh	Pennsylvania	205.2	3.8
● 15	Kyger Creek	Ohio	202.3	6.2
● 16	Conesville	Ohio	200.8	5.2
● 17	Madrid	Missouri	198.9	5.6
● 18	Mitchell	West Virginia	171.3	4.0
● 19	Hatfield	Pennsylvania	171.2	4.1
● 20	Homer City	Pennsylvania	169.1	3.2
21	Gaston	Alabama	169.1	2.8
● 22	Montrose	Missouri	162.0	11.7
● 23	Eastlake	Ohio	155.0	4.9
● 24	Big Bend	Florida	153.2	4.6
● 25	Kammer	West Virginia	149.3	6.7
26	Keystone	Pennsylvania	142.3	2.7
● 27	Brunner Island	Pennsylvania	139.0	3.0
● 28	Coffeen	Illinois	137.3	6.9
● 29	Gallatin	Tennessee	137.1	4.5
30	Sammis	Ohio	137.0	2.5
● 31	Johnsonville	Tennessee	135.3	3.7
32	Cardinal	Ohio	126.0	3.0
● 33	Colbert	Alabama	125.9	3.7
● 34	Hill	Missouri	121.6	8.5
● 35	Cayuga	Indiana	115.9	4.1
36	Stuart	Ohio	112.8	1.8
37	Montour	Pennsylvania	109.5	2.3
38	Petersburg	Indiana	108.5	2.9
● 39	Yates	Georgia	106.6	3.1
40	Amos	West Virginia	105.1	1.2
● 41	Joppa	Illinois	100.1	3.3
● 42	Sioux	Missouri	97.2	4.5
43	Shawnee	Kentucky	96.6	2.2
● 44	Ft Martin	West Virginia	95.1	3.0
● 45	Tanners Creek	Indiana	94.9	4.2
● 46	Mill Creek	Kentucky	94.1	4.1
47	Morgantown	Maryland	92.0	2.8
48	Mount Storm	West Virginia	91.7	2.9
49	Miami Fort	Ohio	89.5	2.6
● 50	Avon Lake	Ohio	89.5	4.1
51	Kingston	Tennessee	88.6	1.7
52	Belews Creek	North Carolina	86.6	1.5
● 53	Ghent	Kentucky	85.4	3.3
54	Marshall	North Carolina	85.1	1.6
● 55	Burger	Ohio	84.7	6.1
56	Beckjord	Ohio	84.4	2.8
57	Gorgas 2 and 3	Alabama	84.3	2.4
58	Brayton	Massachusetts	83.2	2.1
● 59	Sevier	Tennessee	81.4	3.2
60	Four Corners	New Mexico	80.7	1.1
61	La Cygne	Kansas	78.0	2.5
62	Northport	New York	77.6	2.2
● 63	Crist	Florida	76.3	3.6
● 64	S. Oak Creek	Wisconsin	75.7	4.7
● 65	Michigan City	Indiana	75.4	4.7
● 66	Allen	Tennessee	73.9	3.7
● 67	Crystal River	Florida	72.6	3.1
● 68	Breed	Indiana	71.0	6.6
69	Canal	Massachusetts	70.6	2.3
70	Roxboro	North Carolina	70.5	1.2
● 71	Ashtabula	Ohio	68.5	5.6
● 72	Coleman	Kentucky	68.3	4.0
73	Centralia	Washington	68.3	1.7
74	Monticello	Texas	68.2	1.1
75	Widows Creek	Alabama	67.4	1.7
● 76	Wabash River	Indiana	66.0	3.9
● 77	Watson	Mississippi	65.9	2.6
● 78	Campbell	Michigan	65.5	3.1
79	Asbury	Missouri	65.0	9.3
80	Shawville	Pennsylvania	64.7	3.2

Source: E. H. Pechan and Associates, July 1982, "Estimates of Sulfur Oxide Emissions from the Electric Utility Industry." Report Prepared for EPA.

Table 3

"TOP 50" PLANTS BY STATE

	Number of "Top 50" Plants	"Top 50" 1980 Emissions	"Top 50" Reductions	Percent Reductions
Alabama	1	125.9	105.4	84
Florida	3	302.0	255.8	85
Georgia	2	316.4	261.3	83
Illinois	4	702.2	617.9	88
Indiana	7	1,016.9	895.0	88
Kentucky	4	590.5	487.0	82
Michigan	1	65.5	52.7	80
Mississippi	1	65.9	56.0	85
Missouri	5	816.8	720.3	88
Ohio	8	1,421.2	1,261.3	89
Pennsylvania	4	684.5	568.4	83
Tennessee	5	784.5	679.1	87
W. Virginia	4	630.5	539.1	86
Wisconsin	1	75.7	66.3	88
TOTAL	50	7,598.5	6,565.4	86

Sulfur Di[illegible]de Emissions
(million tons/yr.)

	U.S.						
	1980	1985	1990	1995	2000	2005	2010
Total							
MOI[1]	26.5	--	25.3	--	29.3	--	—
EEI[2a]	27.3	26.9	27.2	29.4	31.1	--	33.4
EEI[2b]	27.3	28.7	29.4	32.0	34.6	--	35.0
Utility							
MOI[1]	17.3	--	17.5	--	17.9	--	--
EEI[2a]	17.5	17.6	17.9	18.6	18.2	—	18.2
EEI[2b]	17.5	19.3	20.1	21.2	21.6	--	19.8
EPA[3]	17.4	18.8	20.0	20.2	19.6	--	18.7
NWF[4]	--	--	19.6	--	21.0	--	--
Industry							
MOI[1]	7.4	--	5.9	--	9.3	--	--
EEI[2c]	7.5	7.4	7.2	8.6	10.5	--	12.2

	Eastern 31-states						
	1980	1985	1990	1995	2000	2005	2010
Total							
MOI[1]	21.8	--	21.4	--	24.3	--	--
EEI[2a]	21.7	21.2	21.6	23.5	23.9	--	24.6
EEI[2b]	21.7	23.5	24.2	26.6	27.9	--	26.7
Utility							
MOI[1]	16.0	--	15.9	--	16.1	--	--
EEI[2a]	16.2	15.5	15.7	15.9	15.1	--	14.5
EEI[2b]	16.2	17.8	18.3	19.0	19.1	--	16.6
EPA[3]	16.2	17.1	17.9	18.0	17.1	--	15.8
NWF[4]	--	--	17.8	--	18.1	--	--
EEI[5]	--	--	18.3	—	--	--	--
Industry							
MOI[1]	4.4	--	4.1	--	6.7	--	--
EEI[2c]	3.8	4.2	4.4	6.3	7.2	--	8.2
EEI[5]	--	--	4.4	--	--	--	--

Sources of Estimates:

1. MOI - Emissions, Costs and Engineering Assessment, Work Group 3B, United States-Canada Memorandum of Intent on Transboundary Air Pollution, June 15, 1982.
2. EEI - "Summary of Forecasted Emissions of Sulfur Dioxide and Nitrogen Oxides in the United States Over the 1980 to 2010 Period", Prepared by ICF Incorporated and National Economic Research Associates for the Edison Electric Institute and Utility Air Regulatory Group, April 1982.
   2a - National Economic Research Associates (NERA) estimate
   2b - ICF Incorporated estimate
   2c - Joint NERA/ICF estimate
3. EPA - personal communication from Ms. J. Austin, EPA. Projections prepared for EPA by ICF Incorporated, using assumptions stated in "Analysis of a 10 Million Ton Reduction in Emissions from Existing Utility Powerplants", ICF Incorporated, June 1982.
4. NWF - "Cost and Coal Production Effects of Reducing Utility Sulfur Dioxide Emissions", prepared for National Wildlife Federation and National Clean Air Coalition by ICF Incorporated, November 14, 1981.
5. EEI - "January 25, 1982 Preliminary ICF Analysis of the Mitchell Bill Prepared for the Edison Electric Institute", Edison Electric Institute letter, February 8, 1982.

Table 5

CONTROL PROGRAM COSTS

H.R. 3400

- Annual contribution to trust fund is $2.0 billion (1982 dollars)
- Trust fund must raise $12.6 billion (1982) dollars to pay 90 percent of capital costs for "Top 50" plants
- Annual costs of program:

  Phase 1. During years before control program implementation (tax only): $2.0 billion/yr (1982 dollars) [$1.7 billion/yr (1980 dollars)]

  Phase 2. During years with both tax and control program costs: $4.5 to 5.2 billion/yr (1982 dollars) [$3.8 to $4.5 billion/yr (1980 dollars)]

  Phase 3. During years with control program costs only (tax eliminated): $2.4 to $3.2 billion/yr (1982 dollars) [$2.1 to $2.8 billion/yr (1980 dollars)]

Similar Proposals

- Annual costs of program without trust fund: $4.5 to 5.3 billion/yr (1982 dollars) [$3.9 to $4.6 billion/yr (1980 dollars)]
- Annual costs of program without trust fund and "Top 50" plant technology requirement: $2.9 to 4.0 billion/yr (1982 dollars) [$2.5 to 3.4 billion/yr (1980 dollars)]

Table 6

ESTIMATES OF RESIDENTIAL ELECTRIC RATE INCREASES
(Assuming all reductions are achieved by utility sources only)

STATE-WIDE AVERAGE RATE INCREASE (percent)
(Note: see text for explanation of proposals)

	<<< H.R. 3400 >>>			* <<< SIMILAR PROPOSALS >>>	
STATE	*PHASE 1	*PHASE 2	*PHASE 3	*NO FUND	*ALTERNATE
ALABAMA	1.2	2.2 to 3.1	1.0 to 2.0	1.9 to 2.8	1.0 to 2.1
ARIZONA	1.4	1.4 to 1.4	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
ARKANSAS	1.1	1.1 to 1.1	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
CALIFORNIA	1.5	1.5 to 1.5	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
COLORADO	1.7	1.7 to 1.8	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
CONNECTICUT	0.6	0.6 to 0.6	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
DELAWARE	1.1	1.1 to 1.1	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
DISTRICT OF COL.	1.8	1.8 to 1.8	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
FLORIDA	1.3	2.2 to 2.8	0.9 to 1.5	2.1 to 2.7	1.3 to 2.4
GEORGIA	1.6	7.4 to 8.2	5.8 to 6.5	8.3 to 9.0	7.6 to 9.0
IDAHO	2.9	2.9 to 2.9	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
ILLINOIS	1.0	3.1 to 3.6	2.1 to 2.6	4.3 to 4.8	3.7 to 4.6
INDIANA	1.6	7.4 to 9.3	5.8 to 7.7	12.1 to 14.0	7.2 to 10.6
IOWA	1.3	1.3 to 1.6	0.0 to 0.3	0.0 to 0.3	0.0 to 0.3
KANSAS	1.6	1.6 to 1.7	0.0 to 0.1	0.0 to 0.1	0.0 to 0.1
KENTUCKY	2.0	8.6 to 10.2	6.7 to 8.2	12.8 to 14.3	6.1 to 8.0
LOUISIANA	1.9	1.9 to 1.9	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
MAINE	0.6	0.8 to 0.8	0.2 to 0.2	0.2 to 0.2	0.2 to 0.2
MARYLAND	0.9	3.1 to 3.8	2.1 to 2.9	2.1 to 2.9	2.1 to 2.9
MASSACHUSETTS	1.0	1.8 to 1.9	0.8 to 0.9	0.8 to 0.9	0.8 to 0.9
MICHIGAN	1.2	2.3 to 3.0	1.1 to 1.7	1.8 to 2.5	0.6 to 1.3
MINNESOTA	1.2	1.8 to 2.9	0.7 to 1.7	0.7 to 1.7	0.7 to 1.7
MISSISSIPPI	1.5	3.2 to 3.6	1.6 to 2.1	3.5 to 3.9	1.5 to 3.0
MISSOURI	1.6	5.7 to 6.0	4.1 to 4.5	9.9 to 10.2	2.3 to 3.1
MONTANA	2.6	3.1 to 3.6	0.5 to 1.0	0.5 to 1.0	0.5 to 1.0
NEBRASKA	1.2	1.2 to 1.4	0.1 to 0.2	0.1 to 0.2	0.1 to 0.2
NEVADA	1.6	1.6 to 1.6	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
NEW HAMPSHIRE	1.1	4.1 to 4.8	3.1 to 3.7	3.1 to 3.7	3.1 to 3.7
NEW JERSEY	0.8	1.7 to 2.1	0.9 to 1.3	0.9 to 1.3	0.9 to 1.3
NEW MEXICO	1.3	1.3 to 1.3	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
NEW YORK	0.8	2.0 to 2.3	1.2 to 1.5	1.2 to 1.5	1.2 to 1.5
NORTH CAROLINA	1.6	2.8 to 4.7	1.3 to 3.1	1.3 to 3.1	1.3 to 3.1
NORTH DAKOTA	1.9	2.8 to 4.7	1.0 to 2.8	1.0 to 2.8	1.0 to 2.8
OHIO	1.4	7.0 to 8.2	5.5 to 6.7	11.7 to 12.9	7.1 to 8.5
OKLAHOMA	1.8	1.8 to 1.8	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
OREGON	2.1	2.1 to 2.1	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
PENNSYLVANIA	1.2	3.4 to 4.0	2.2 to 2.8	4.1 to 4.7	3.3 to 3.8
RHODE ISLAND	1.0	1.0 to 1.0	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
SOUTH CAROLINA	1.0	3.0 to 4.3	2.0 to 3.4	2.0 to 3.4	2.0 to 3.4
SOUTH DAKOTA	1.7	2.6 to 3.0	0.9 to 1.4	0.9 to 1.4	0.9 to 1.4
TENNESSEE	2.6	8.9 to 8.9	6.4 to 6.4	15.6 to 15.6	3.2 to 8.3
TEXAS	1.6	1.7 to 1.9	0.1 to 0.3	0.1 to 0.3	0.1 to 0.3
UTAH	1.4	1.4 to 1.4	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
VERMONT	0.3	0.3 to 0.3	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
VIRGINIA	0.9	1.2 to 2.2	0.4 to 1.3	0.4 to 1.3	0.4 to 1.3
WASHINGTON	4.3	4.3 to 4.3	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
WEST VIRGINIA	1.8	4.9 to 5.2	3.1 to 3.5	7.0 to 7.3	6.5 to 7.5
WISCONSIN	1.4	2.7 to 2.7	1.3 to 1.3	2.9 to 2.9	0.4 to 0.4
WYOMING	2.6	2.6 to 2.6	0.0 to 0.0	0.0 to 0.0	0.0 to 0.0
|48 STATE TOTAL|	1.4	3.2 to 3.7	1.7 to 2.3	3.2 to 3.7	2.0 to 2.8

Table 7

1980 NATIONAL UTILITY COAL PRODUCTION BY REGION AND SULFUR CONTENT (lbs. SO_2/million Btu)

A. 1980 Utility Coal Production, All Plants (10^6 tons)

Type/Region	U.S.	Appalachia[1]	Central[2]	Great Plains	Rocky Mountains
< 1.2	111.2	12.8	< .1	66.9	31.6
1.2-3.0	221.7	122.2	31.4	50.5	17.6
> 3.0	200.1	124.3	75.8	0	0
All Coal	533.0	259.2	107.3	117.4	49.1

- o Coals with sulfur content > 3.0 lbs. SO_2/mm Btu most susceptible to fuel switching.
- o Coals > 1.2 lbs. SO_2/mm Btu also above limit.

B. 1980 Utility Coal Production for "Top 50" Plants (10^6 tons)

Type/Region	U.S.	Appalachia[1]	Central[2]	Great Plains	Rocky Mountains
< 1.2	3.2	1.3	0	0.5	1.5
1.2-3.0	8.6	5.0	1.2	2.3	0
> 3.0	122.8	76.6	46.2	0	0
All Coal	134.6	82.9	47.5	2.7	1.5

- o 91% of coal use by "Top 50" plants > 3.0 lbs. SO_2/mm Btu.

C. Percent of Regional Coal Production for "Top 50" Plants

Type/Region	U.S.	Appalachia[1]	Central[2]	Great Plains	Rocky Mountains
<1.2	< 1%	< 1%	0%	< 1%	3%
1.2-3.0	2%	2%	1%	2%	0%
> 3.0	23%	30%	43%	0%	0%
All Coal	25%	32%	44%	2%	3%

- o 61 percent of all coal > 3.0 lbs. SO_2/mm Btu used by "Top 50" plants.

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[1] For this analysis, all coal produced in Kentucky and West Virginia are included in the Appalachian region.

[2] Includes Texas coal.

Table 8

CHANGES IN COAL PRODUCTION DUE TO ACID RAIN CONTROL LEGISLATION

Note: Changes in production as if control plan imposed in 1980. Estimates do not include production increases by 1995 to meet increased electricity demand. Total production increases shown are due to shifts to lower heat-value coals.

A. 10 million ton SO_2 reduction, including control technology on "Top 50" plants.

Million Tons Change From 1980

	Total	East	West
0.0-1.2 *	+12.1	-4.2	+16.3
1.2-3.0 *	+31.3	+28.5	+2.8
> 3.0 *	-17.5	-17.5	0
TOTAL *	+25.9	+6.8	+19.1

Percent Change from 1980 Production

	Total	East	West
0.0-1.2 *	+11	-33	+17
1.2-3.0 *	+14	+19	+4
> 3.0 *	-9	-9	0
TOTAL *	+5	+2	+11

B. 10 million ton SO_2 reduction, no technology required.

Million Tons Change from 1980

	Total	East	West
0.0-1.2 *	+28.9	-5.2	+34.1
1.2-3.0 *	+54.4	+54.8	-0.5
> 3.0 *	-50.7	-50.7	0
TOTAL *	+32.6	-1.1	+33.6

Percent Change From 1980 Production

	Total	East	West
0.0-1.2 *	+26	-41	+35
1.2-3.0 *	+25	+36	+1
> 3.0 *	-25	-25	0
TOTAL *	+6	-0	+20

ICF INCORPORATED International Square, 1850 K Street, Northwest, Washington, D.C. 20006 (202) 862-1100

September 22, 1983

MEMORANDUM

TO : Alliance for Clean Energy

FROM : Daniel E. Klein DK

SUBJECT: Analysis of Coal Production and Employment Impacts of the Waxman-Sikorski Bill and a Cost-Effective Equivalent

This memorandum presents ICF's findings of an analysis of the Waxman-Sikorski Bill and a cost-effective equivalent. Special attention has been devoted to shifts in regional coal production and changes in employment in coal mining and transportation.

EXECUTIVE SUMMARY OF FINDINGS

- Three scenarios were examined for a 1995 forecast period. The base case represents a reference case forecast that assumes no acid rain mitigation legislation. The Waxman-Sikorski case is our analysis of H.R. 3400, and represents a reduction of about 9.5 million tons of sulfur dioxide emissions by electric utilities and industrial coal-burning facilities. The cost-effective equivalent case was designed to result in the same level of sulfur dioxide emission reductions as achieved in the Waxman-Sikorski case, but permitted states and utilities free choice to pursue emission reduction strategies in the most cost-effective manner.

- Costs -- The Waxman-Sikorski case results in higher costs to the nation than the cost-equivalent case. The requirements in Waxman-Sikorski would increase the net cost to the nation by about one billion dollars per year (in mid-1982 dollars) relative to the cost-effective equivalent. However, the direct costs to utilities would be significantly less due to subsidy payments.

- Regional coal production -- In the cost-effective equivalent case, fuel switching is often selected as a least-cost means of reducing sulfur dioxide emissions. Accordingly, forecasted coal production tends to decline in higher-sulfur regions such as Northern Appalachia and the Midwest, and increase in lower-sulfur regions such Central Appalachia and the Rockies. Under the Waxman-Sikorski case, there would be a heavy reliance upon retrofit scrubbers as the means for reducing emissions. As such, there are relatively few shifts in coal production relative to base case forecasts, with some regions actually showing an increase in forecasted high-sulfur coal production.

- Employment shifts -- Relative to the Waxman-Sikorski case, the cost-effective equivalent case could result in many jobs shifting from higher-sulfur to lower-sulfur regions by 1995. Relative to 1980 employment levels, the cost-effective equivalent case indicates lower employment levels in higher-sulfur regions such as the Midwest and parts of Northern Appalachia. For the United States as a whole, the forecasted number of jobs in coal mining and transportation shows only modest changes in the three 1995 cases, but appears to be slightly higher in the cost-effective equivalent case than under Waxman-Sikorski.

FRAMEWORK FOR ANALYSES

Cases Examined

In order to evaluate the potential magnitude of the changes in the coal market, we have analyzed three scenarios for 1995:

- The base case represents a reference case forecast that assumes no acid rain mitigation legislation. This is the same base case that was specified by EPA and used in recent acid rain analyses.

- The Waxman-Sikorski case is an analysis of HR-3400 which was performed for EPA, and includes its provisions for mandatory scrubbing at selected plants, scrubber subsidies, sulfur dioxide emission rollbacks, and other requirements specific to this particular bill. In this case, the total emissions of sulfur dioxide by electric utilities in the U.S. is forecasted to be 10.7 million tons in 1995, a reduction of about 9.0 million tons from the 1995 base case. Industrial coal-burning facilities were assumed to reduce sulfur dioxide emissions by about 0.5 million tons through fuel shifting.

- The cost-effective equivalent case was designed to result in the same level of sulfur dioxide emissions in the U.S. as achieved in the Waxman-Sikorski case. However, this case did not provide scrubber subsidies, and did not require specific sulfur dioxide control strategies or emission limits. States and utilities were free to pursue strategies for achieving the required sulfur dioxide reductions in the most cost-effective manner including retrofitting scrubbers, dispatching plants in a least-emissions manner, switching to lower-sulfur fuels, coal blending, and trading of emissions among states. As in the Waxman-Sikorski case, industrial facilities were assumed to reduce emissions through shifts to lower-sulfur fuels.

The Base Case and alternative cases are consistent with previous ICF analyses for EPA. The regional coal production levels are sensitive not only to the acid rain legislation assumptions, but also to the base case assumptions. The base case, initially specified by EPA, may overstate high-sulfur coal production. If so, then production and job losses (from 1980 levels) in high-sulfur regions resulting from acid rain legislation could be understated.

Coal Mining Employment

This analysis also incorporates an improved methodology for estimating employment changes in coal mining. Previous analyses of coal mining employment have relied upon use of historic productivity estimates applied to forecasted regional coal production.

However, the average productivity in 1980 includes production from many metallurgical coal mines which typically have lower productivity than those mines producing steam coals for the industrial and utility markets. Growth in coal demand, as well as shifts resulting from acid rain legislation, will be concentrated in steam coal production. Accordingly, in regions where metallurgical coal production is substantial, use of historic productivity estimates will tend to understate future productivity, overstate future employment levels, and exaggerate shifts (both gains and losses) in mining employment across the scenarios. Further, future productivity in a region could change from historic productivity as a result of changes in the proportion of surface and deep-mined coal, changes in mining technologies, changes in labor practices, and changes resulting from depletion of the more efficient mines.

In recognition of these problems inherent with the use of historic productivity values, we have undertaken the development of an improved methodology for estimating coal mining employment. Specifically, this methodology incorporates the same estimates of coal mining productivity that are used in ICF's Coal and Electric Utilities Model (CEUM) to forecast regional coal production and utility fuel use. In CEUM, coal supply is represented in the form of coal supply curves. There are over 200 coal supply curves, one for each type of coal in each of 40 coal supply regions. Each supply curve is represented as a step function, where each step represents a different type of mine (in terms of mine size, seam thickness, overburden ratio, and other factors). In developing the minimum acceptable selling price for each mine-type on each coal supply curve, the mine costing program in CEUM develops an estimate of productivity in terms of tons per man-day. Using these productivity estimates, we estimated the number of workers associated with the forecasted coal production of any given coal-type and region. In so doing, this improved methodology is able to circumvent many of the problems inherent in the use of historic productivity values.

Coal Transportation Employment

This analysis has also incorporated improvements in the estimation of coal transportation employment. In earlier analyses, changes in coal transportation employment were approximated by the changes in total ton-miles divided by a transportation productivity equal to that of a hypothetical unit coal train.

In this analysis, we have developed estimates of the labor productivity in coal transportation for each mode of transportation represented in CEUM. For example, transportation productivity for water movements of coal were estimated for 13 inland waterways, the Gulf intracoastal waterway, Great Lakes movements, and trans-oceanic movements. These productivity estimates were developed as functions of representative ship or barge size, crew size, average days per worker-year, and average speed. Similar methodologies were used in the estimation of labor productivity in unit train, single-car, and truck movements. In all cases, we have tended to be conservative (i.e., tending toward the low end of the range) in our estimates of the number of transportation workers involved; in particular, we have focused primarily upon those workers actually in motion with the coal and have tended to disregard support labor.

The resulting estimates of transportation labor productivity developed for this analysis can be summarized as follows:

	Ton-Miles Per Worker-Year (millions)	Workers per 10^9 Ton-Miles
Unit Train	53	19
Single-Car Rail	26	38
Trucks	0.6	1,695
Barges	7-52	19-153
Intracoastal Waterway	20-26	38-50
Great Lakes	17-44	23-58
Trans-Oceanic	97-243	4-10

These estimated worker requirements were used with the individual coal movements forecasted in CEUM. In CEUM, there is a transportation route description for coal moving between each origin and destination, by consuming sector. These route descriptions are comprised of mileages by mode of transportation. Using the productivity estimates summarized above, together with the route descriptions and forecasted coal flows, the number of coal transportation workers can be approximated for each forecast case.

POTENTIAL MARKET IMPACTS

The Waxman-Sikorski and cost-effective equivalent alternatives for implementing an acid rain mitigation strategy lead to substantial differences in forecasted retrofit scrubber capacity, coal consumption, regional coal production, total costs, and employment in coal mining and transportation. These changes are discussed below.

Scrubber Retrofits

Our analysis indicates that shifting to lower-sulfur fuels is often less expensive than retrofitting scrubbers on existing facilities as a means of reducing sulfur dioxide emissions. As such, there were only 2.5 gigawatts of retrofit scrubber capacity forecasted under the cost-effective equivalent relative to a 1995 base case without acid rain mitigation requirements. In contrast, the scrubber requirements and capital subsidy provisions of the Waxman-Sikorski case are forecasted to lead to 67.7 gigawatts of additional retrofit scrubber capacity in 1995. See Table 1.

TABLE 1

SCRUBBER CAPACITY UNDER ALTERNATIVE
ACID RAIN MITIGATION APPROACHES
(gigawatts)

	Scrubbed Capacity		Additional Retrofit Scrubbers in 1995	
	1980 Actual	1995 Base Case	Waxman-Sikorski	Cost-Effective Equivalent
Total U.S.	35.5	100.6	+67.7	+2.5

Changes in Coal Consumption

Coal's relative share of future energy requirements in the utility and industrial sector was assumed to be independent of any imposed acid rain regulatory program. Coal as a boiler fuel continues to remain more economic than oil and gas for many fuel applications within the utility and industrial sectors. Particularly in the electric utility sector, switching from coal to oil or gas is one of the least cost-effective emissions control strategies. Other factors such as regulatory, financial, managerial preference, and fuel distribution issues are likely to be more important in determining the relative share of future energy markets for coal relative to oil and gas than will acid rain legislation. Therefore, the total amount of coal consumed by utility and industrial boilers was assumed to remain unchanged under the alternative acid rain mitigation scenarios.

However, the types of coal and oil demanded will shift significantly as some utilities and industrial facilities shift to lower-sulfur fuels to meet emission reduction requirements. Further, the demand for natural gas would likely increase under acid rain legislation because gas can be cost-effectively substituted for oil (though generally not for coal). However, this was not evaluated in this or any of the EPA analyses. Table 2 indicates the changes in forecasted 1995 coal consumption by sulfur level in the U.S. for the utility and industrial sectors.

TABLE 2

CHANGES IN FORECASTED 1995 COAL CONSUMPTION
IN THE U.S.
(10^{15} Btu (quads))

	1995 Base Case	Changes With Acid Rain Legislation	
		Waxman-Sikorski	Cost-Effective Equivalent
Utility			
Low Sulfur	4.8	+0.2	+3.4
Low-Medium Sulfur	2.7	+0.5	+0.8
High-Medium Sulfur	6.2	-1.5	-1.6
High Sulfur	4.8	+0.9	-2.6
Total	18.5	+0.1	-
Industrial			
Low Sulfur	1.7	+0.4	+0.4
Low-Medium Sulfur	0.2	-0.1	-0.1
High-Medium Sulfur	0.8	-0.3	-0.3
High Sulfur	0.6	-0.1	-0.1
Total	3.3	-	-

Under the cost-effective equivalent case, the shift to lower-sulfur coals is more pronounced, reflecting the greater reliance upon fuel switching as a least-cost strategy. Under the Waxman-Sikorski case, the shift to lower-sulfur fuels is much less pronounced since the scrubber requirements and capital subsidies preclude or reduce the attractiveness of fuel switching. In fact, because of the large amount of retrofit scrubber capacity forecasted under the Waxman-Sikorski case, there would be a significant shift from high-medium sulfur coals to high-sulfur coals by some of the utilities retrofitting scrubbers.

Changes in Regional Coal Production

Consistent with the shifts to lower-sulfur coals by utility and industrial boilers, the cost-effective equivalent case would lead to a shift in the forecasted coal production by region. Table 3 shows coal production by aggregate region for 1995, and also indicates the changes from 1980 to 1995. Supply regions are shown in Figure 1.

Under the cost-effective equivalent case, higher-sulfur regions such as Northern Appalachia and the Midwest are forecasted to have lower levels of production than would have been the case in the absence of acid rain mitigation legislation. Our forecasts indicate 1995 production from these regions as being less than 1980 production levels. Conversely, lower-sulfur regions such as Central Appalachia and parts of the West are forecast to have significantly higher levels of coal production.

Under the Waxman-Sikorski case, there are only slight changes in forecasted coal production relative to the base case. This is because most of the sulfur dioxide emission reductions are attained through scrubber retrofits. As such, there is little shifting to lower-sulfur fuels in order to reduce emissions, and production in lower-sulfur producing regions such as Central Appalachia and parts of the West show little change from 1995 base case levels.

With the requirements and/or subsidies to retrofit scrubbers under the Waxman-Sikorski case, there is less incentive to pay a premium for lower-sulfur fuels at these plants. As a result, our forecasts under the Waxman-Sikorski case also indicate a shift within several of the higher-sulfur producing regions from high-medium sulfur coals to high and very-high sulfur coals.

For this analysis, few shifts to lower-rank coals were forecast. This reflects an assumption that individual boilers designed to burn bituminous coals would not find shifting to lower-rank coals economic after consideration of powerplant modification costs, capacity derates, heat rate increases, and increased costs for flame stabilization. To the extent that such shifts would occur, the estimated cost impacts would be lower, and the forecasted production increases in Eastern and Western bituminous low-sulfur coal fields would be less.

Total Costs

Relative to no legislation, both acid rain mitigation cases would result in higher costs to electric utilities and industry. See Table 4.

In the cost-effective equivalent case, cumulative capital costs by 1995 would increase by 1.5 billion dollars (in mid-1982 dollars) as a result of the acid rain legislation evaluated. This relatively small amount reflects the greater reliance upon fuel switching instead of retrofit scrubbing as a cost-effective means of reducing emissions. Under the Waxman-Sikorski case, the level of retrofit scrubber capacity is much greater. As a result, the cumulative capital costs exceed 21 billion dollars, most of which would be subsidized.

TABLE 3

REGIONAL COAL PRODUCTION[a]
(million tons)

Region	1980	1995			Change from 1980 to 1995		
		Base Case	Waxman-Sikorski	Cost-Effective Equivalent	Base Case	Waxman-Sikorski	Cost-Effec Equivale
Northern Appalachia	185	213	202	157	28	17	(28)
Central Appalachia	233	295	299	350	62	67	117
Southern Appalachia	26	26	26	27	(1)	(0)	0
Total, Appalachia[b]	444	534	528	533	89	84	89
Midwest	134	182	187	88	48	53	(46)
Eastern Northern Great Plains	17	33	33	33	16	16	16
Western Northern Great Plains	125	250	250	270	125	126	145
Total, Northern Great Plains[b]	142	283	283	303	141	141	161
Central West	13	23	23	21	11	10	9
Gulf	29	126	126	126	97	97	97
Rockies	32	73	78	133	40	46	101
Southwest	29	61	59	78	32	30	49
Northwest	5	6	6	4	1	1	(1)
Alaska	1	12	12	12	12	12	12
Total, Rest of West[b]	109	302	305	375	193	196	266
Total U.S.[b]	830	1,300	1,303	1,299	470	473	469

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a/ Regional details in Attachment A-1.

b/ Totals may not add due to independent rounding.

FIGURE 1

CEUM COAL SUPPLY REGIONS

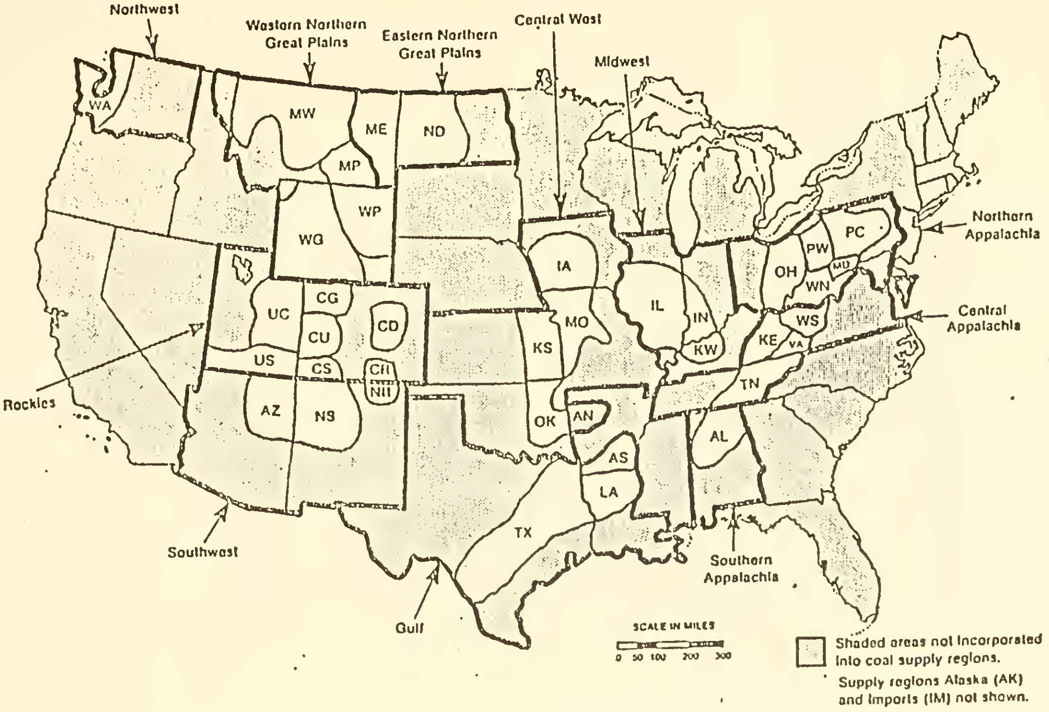

TABLE 4

INCREASED CAPITAL AND ANNUALIZED COSTS IN 1995 DUE TO ACID RAIN LEGISLATION (billions of 1982 $)

	Increases Relative to No Acid Rain Legislation	
	Waxman-Sikorski	Cost-Effective Equivalent
A. UTILITY SECTOR		
Cumulative Capital Costs		
Total	+21.5	+1.5
- Subsidy Payments*	+18.0	-
= Direct Cost to Utilities	+3.5	+1.5
Annualized Costs		
Total	+3.8	+2.6
- Subsidy Payments*	+2.1	-
= Direct Cost to Utilities	+1.7	+2.6
B. INDUSTRIAL SECTOR		
Annualized Costs		
Total	+0.4	+0.6
- Subsidy Payments*	-	-
= Direct Cost to Consumer	+0.4	+0.6
C. TOTAL		
Annualized Costs		
Total	+4.2	+3.2
- Subsidy Payments*	+2.1	-
= Direct Costs	+2.1	+3.2

---

* Location of where the subsidy costs are incurred cannot be determined independent of the subsidy financing scheme.

On an annualized basis, the cost-effective equivalent case would entail total annual costs of 3.2 billion dollars (in mid-1982 dollars) relative to no acid rain legislation. The Waxman-Sikorski case would entail annual costs of 4.2 billion dollars (or one billion dollars more per year), half of which would be reflected in the subsidy.

There are a number of uncertainties with respect to the implementation of a subsidy program which could result in either higher or lower differential cost impacts. These uncertainties and the resulting impacts have not been addressed in this analysis.

Changes in Coal Mining and Transportation Employment

The potential shifts in regional coal production as a result of acid rain mitigation legislation could also lead to coal mining job losses in some regions, and gains in other regions. Additionally, coal distribution patterns would also change, leading to employment changes in the transportation industries.

Table 5 summarizes the changes in coal mining and transportation employment in 1995 under the different scenarios. Attachments A-1 and A-2 develop these estimates in greater detail.

-- Coal Mining

Because coal demand is forecasted to grow in all cases, 1995 coal mining employment is also forecasted to grow. Our estimates indicate that the net changes in coal mining employment in both the cost-effective equivalent and Waxman-Sikorski cases indicate a small decline from the forecasted base case national employment levels. The net national job losses under the Waxman-Sikorski case are slightly greater than those under the cost-effective equivalent case.

Consistent with the shifts in regional coal production, the cost-effective equivalent case could lead to shifts in regional coal mining employment. Under the cost-effective equivalent case, production and employment would decline from 1980 levels in higher-sulfur regions such as the Midwest and parts of Northern Appalachia. A forecasted decline is not necessarily the same as forced mined closings and/or layoffs, since between 1980 and 1995 some mines will have depleted their reserves and some miners will have retired.

Forecasted employment levels do not rise or fall proportional to changes in regional coal production, as had been the case in earlier preliminary analyses which relied upon the use of historic productivity estimates. For example, production in some regions (such as Colorado Uinta) is forecasted to rise at a much faster rate than employment levels. This is because much of the current production in these regions is comprised of lower productivity metallurgical mines, whereas the growth in production will largely be in higher productivity steam coal mines. In another example, intraregional shifts in coal production by sulfur content can lead to greater employment

TABLE 5

SHIFTS IN COAL MINING AND TRANSPORTATION EMPLOYMENT IN 1995 UNDER DIFFERENT ACID RAIN IMPLEMENTATION PROGRAMS

	Average Number of Workers in 1980 (10^3 Workers)	Change in Employment from 1980 to 1995 (10^3 Workers)		
		1995 Base Case	Waxman-Sikorski	Cost-Effecti Equivalent
. COAL MINING[a]				
Northern Appalachia	69.1	+24.5	+17.0	+1.1
Central Appalachia	92.6	+41.3	+44.3	+68.2
Southern Appalachia	11.4	+2.9	+3.0	+3.7
Total, Appalachia	173.1	+68.7	+64.3	+73.1
Midwest	35.1	+17.0	+16.1	-10.1
Eastern Northern Great Plains	1.7	+1.3	+1.2	+1.3
Western Northern Great Plains	6.0	+6.8	+6.9	+8.8
Total, Northern Great Plains	7.7	+8.1	+8.1	+10.0
[illegible]ntral West	2.9	+5.2	+4.8	+4.6
Gulf	1.7	+9.6	+9.6	+9.6
Rockies	7.2	+10.1	+10.8	+23.6
Southwest	2.5	+4.0	+3.6	+8.3
Northwest	0.6	+0.3	+0.3	-
Alaska	0.0	+1.0	+1.0	+1.0
Total, Rest of West	15.1	+30.0	+30.1	+47.2
Total U.S.	231.0	+124.0	+118.7	+120.2
. COAL TRANSPORTATION[b]				
Transportation Employment	14.5	+10.7	+10.8	+14.9
. TOTAL, MINING AND TRANSPORTATION				
Coal Mining	231.0	+124.0	+118.7	+120.2
Transportation	14.5	+10.7	+10.8	+14.9
Total	245.5	+134.7	+129.5	+135.1

---

[a] Details in Attachment A-1.

[b] Details in Attachment A-2.

requirements without necessarily increasing total regional production. This is illustrated in regions such as Pennsylvania Central, where total production in 1995 is forecasted to decline from 1980 levels. However, in addition to this forecasted decline is a shift from higher-sulfur coals (which in general have higher productivities) to lower-sulfur coals (which in general have lower productivities). Because of these shifts, average productivity in these regions is forecast to decline from base case levels, resulting in a greater number of workers needed to support a lower level of production.

These types of intraregional shifts can be seen in Attachment A-3, where production and employment for an illustrative region (Indiana) are estimated by type of coal and mining method.

- In 1980, most of Indiana's production came from high-sulfur surface mines, with smaller amounts from underground and/or medium-sulfur mines. Stripping ratios ranged from between 12:1 and 25:1 (feet of overburden per foot of coal). Productivity at surface mines averaged about 5,800 tons per worker-year (or about 25 tons per worker-day), covering a range from less than 3,000 to more than 7,000 tons per worker-year.

- By 1995, some of these existing mines will have retired because of exhaustion of reserves. New replacement mines at a given sulfur level would generally have less favorable geologic characteristics, either surface mines which are smaller and/or have higher overburden ratios, or shifts to deep mines. In each case, the productivity of these replacement mines will tend to be less than that of the older, low-stripping ratio mines, thus requiring more workers for a given production level. For example, we forecast that by 1995 new, high-sulfur surface mines would have stripping ratios of about 25:1 and productivity of about 4,000 tons per worker-year (or about 19 tons per worker-day). At these stripping ratios, new deep mines are cost-competitive in seams about five to six feet thick, with a productivity of about 3,000 tons per worker-year (or about 14 tons per worker-day). These deep mines can be cost competitive despite the lower labor productivity because the surface mines are more capital and power intensive. Hence, a shift to deep production as surface reserves are depleted involves lower productivity and more miners, but without a substantial jump in price.

- In the cost-effective equivalent case, the lower production levels lead to fewer new mine openings, thereby slowing the decline in average productivity. However, the relative increase in demand for medium-sulfur coals observed in the cost-effective

> equivalent case leads to a greater shift from high-sulfur to medium-sulfur coals. Such coals tend to be scarcer in states like Indiana, with thinner seams and/or higher stripping ratios. These mines would tend to have lower productivity than most of the high-sulfur mines, and hence require more employment for a given production level. For example, the medium-sulfur coals are forecasted to be from deep mines in seams about four feet thick. Productivity in these mines is forecasted to be about 2,000 tons per worker-year (or about 9 tons per worker-day), which is considerably lower than the 3,000 ton per worker-year productivities forecasted for high-sulfur deep mines in five to six feet thick seams.

This methodology for estimating coal mining employment represents an improvement over earlier methods which assumed constant productivity within a region over time. In particular, this methodology explicitly recognizes differences resulting from coal quality, method of mining, coal geology, levels of preparation, and mine retirements. This methodology is also sensitive to many key assumptions such as the extent and cost of surface-mineable coals and the rates of retirement for existing coal mines. Because information on such parameters is often sparse, employment forecasts must still be considered somewhat uncertain.

Some states include both higher-sulfur and lower-sulfur regions. Therefore, some of the production and employment shifts among regions would be intrastate. For example, shifts out of Kentucky West, a higher-sulfur region in the Midwest, would be offset in part by gains in Kentucky East, a lower-sulfur region in Central Appalachia. Shifts out of West Virginia North (in Northern Appalachia) would be offset in part by gains in West Virginia South (in Central Appalachia).

-- Coal Transportation

The production shifts forecasted under the cost-effective equivalent alternative would lead to greater requirements for coal transportation. As indicated in Attachment A-2, coal transportation requirements would rise by approximately 100 billion ton-miles in 1995 above the levels forecasted in both the base case and Waxman-Sikorski cases. This in turn would lead to about 4,000 additional jobs required for coal transportation, primarily rail and truck movements. Because of the estimating methodology for transportation employment used in this analysis focuses on those directly involved in the coal movements, we believe these estimates are conservative and likely to understate the number of additional workers needed.

-- Related Employment Changes

These estimated changes in coal mining and transportation employment do not include shifts in related industries. In those regions where mining employment losses occurred, there would likely be additional losses associated with the industries supplying those mines and workers. Conversely, there

ATTACHMENT A-1

ESTIMATED COAL PRODUCTION AND COAL MINING EMPLOYMENT
IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

Supply Region	Production (10^6 tons)				Average Number of Workers (10^3 workers)				Employment Change from 1980 to (10^3 workers)		
		1995 Forecast				1995 Forecast					
	1980	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	1980	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	Base Case	Waxman-Sikorski	Cost-Effec Equivale
Northern Appalachia											
PC	61.4	56.0	51.6	50.2	22.1	26.7	23.6	23.7	4.5	1.4	1.5
PW	31.7	57.9	53.7	38.4	13.9	28.5	25.6	19.2	14.6	11.7	5.3
OH	39.4	41.2	45.5	19.4	14.7	15.0	16.4	6.9	0.3	1.7	-7.8
MD	3.8	2.9	2.9	2.3	1.1	1.2	1.2	0.9	0.1	0.1	-0.2
WN	48.8	54.2	48.4	46.5	17.3	22.2	19.4	19.5	4.9	2.1	2.2
TOTAL	185.1	213.0	202.2	156.8	69.1	93.7	06.1	70.2	24.5	17.0	1.1
Central Appalachia											
WS	72.7	135.4	140.4	163.5	36.9	70.0	73.2	84.1	33.1	36.3	47.2
VA	41.0	42.7	42.9	49.1	16.1	19.2	19.2	22.7	3.1	3.2	6.7
KE	109.2	106.8	107.6	126.6	35.7	40.4	40.7	49.5	4.7	5.0	13.8
TN	9.9	9.8	8.6	10.5	3.9	4.3	3.7	4.5	0.4	-0.2	0.6
TOTAL	232.0	294.8	299.4	349.8	92.6	133.9	136.9	160.8	41.3	44.3	68.2
Southern Appalachia											
AL	26.4	25.9	26.2	26.5	11.4	14.3	14.4	15.1	2.9	3.0	3.7
TOTAL	26.4	25.9	26.2	26.5	11.4	14.3	14.4	15.1	2.9	3.0	3.7
TOTAL APPALACHIA	444.3	533.6	527.8	533.2	173.1	241.8	237.4	246.2	68.7	64.3	73.1
Midwest											
IL	62.5	72.5	87.1	27.7	17.8	20.5	23.6	7.9	2.8	5.9	-9.8
IN	30.9	46.8	40.1	23.9	5.3	14.0	11.1	6.7	8.7	5.0	1.4
KW	41.0	62.6	59.7	36.6	12.0	17.6	16.5	10.4	5.5	4.5	-1.6
TOTAL	134.4	182.0	186.9	00.2	35.1	52.1	51.3	25.0	17.0	16.1	-10.1
TOTAL MIDWEST	134.4	182.0	186.9	88.2	35.1	52.1	51.3	25.0	17.0	16.1	-10.1
Eastern Northern Great Plains											
ND	17.0	32.7	32.6	32.7	1.7	3.0	3.0	3.0	1.3	1.2	1.3
ME	0.3	0.2	0.2	0.2	-	-	-	-	-	-	-
TOTAL	17.3	33.0	32.8	32.9	1.7	3.0	3.0	3.0	1.3	1.2	1.3
Western Northern Great Plains											
MN	-	1.7	1.7	1.7	-	0.4	0.4	0.4	0.4	0.4	0.4
MP	29.6	69.1	71.1	81.5	1.1	2.5	2.6	3.0	1.4	1.5	1.9
WP	68.8	129.8	127.7	129.5	2.0	3.8	3.7	3.8	1.8	1.7	1.8
WG	26.1	49.0	49.0	56.9	2.0	6.0	6.1	7.5	3.2	3.3	4.6
TOTAL	124.5	249.7	250.2	269.7	6.0	12.8	12.9	14.7	6.8	6.9	8.8
TOTAL NORTHERN GREAT PLAINS	141.7	282.5	283.1	302.5	7.7	15.8	15.8	17.7	8.1	8.1	10.0

ATTAC[illegible] A-1 (Continued)

ESTIMATED COAL PRODUCTION AND COAL MINING EMPLOYMENT
IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

Supply Region		Production (10^6 tons)				Average Number of Workers (10^3 workers)				Employment Change from 1980 t (10^3 workers)		
			1995 Forecast				1995 Forecast					
		1980	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	1980	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	Base Case	Waxman-Sikorski	Cost-Eff Equival
Central West												
	IA	0.6	1.0	1.0	1.0	0.1	0.3	0.3	0.3	0.2	0.2	0.
	MO	5.5	6.9	6.9	4.4	1.1	1.8	1.8	1.0	0.7	0.7	-0.
	KS	0.8	3.2	2.3	1.9	0.2	1.1	0.8	0.6	0.9	0.6	0.
	AN	0.3	5.8	5.8	7.0	0.1	2.7	2.7	3.3	2.5	2.5	3.
	OK	5.4	6.3	6.4	6.8	1.3	2.2	2.2	2.4	0.9	0.9	1.
TOTAL		12.6	23.3	22.5	21.1	2.9	8.1	7.8	7.6	5.2	4.8	4.
Gulf												
	TX	29.4	106.8	107.0	107.0	1.7	8.9	9.0	9.0	7.2	7.2	7.
	LA	-	14.5	14.5	14.5	-	1.9	1.9	1.9	1.9	1.9	1.
	AS	-	5.0	5.0	5.0	-	0.5	0.5	0.5	0.5	0.5	0.
TOTAL		29.4	126.2	126.4	126.4	1.7	11.3	11.4	11.4	9.6	9.6	9.
Rockies												
	CG	13.7	19.7	22.5	52.4	1.7	2.4	2.9	8.2	0.7	1.2	6.
	CD	0.4	0.6	0.7	0.7	0.2	0.3	0.4	0.4	0.1	0.2	0.
	CR	0.9	7.7	8.4	16.5	0.4	2.7	2.9	6.0	2.3	2.5	5.
	CU	3.8	10.2	11.4	28.2	1.4	3.4	3.7	8.0	2.0	2.3	6.
	CS	0.1	1.1	1.5	2.1	-	0.2	0.2	0.3	0.1	0.2	0.
	UC	13.2	32.4	30.6	30.8	3.5	8.2	7.8	7.8	4.7	4.3	4.
	US	-	0.0	2.9	2.1	-	-	0.3	0.2	-	0.3	0.
TOTAL		32.1	72.5	78.1	132.7	7.2	17.3	18.0	30.8	10.1	10.8	23.
Southwest												
	AZ	10.9	16.6	14.9	22.0	0.9	1.4	1.3	2.1	0.5	0[illegible]	1.
	NR	1.9	7.1	6.3	16.4	0.6	2.3	2.0	5.7	1.7	1.[illegible]	5.
	NS	16.6	37.6	37.9	38.9	1.0	2.8	2.9	3.0	1.8	1.9	2.
TOTAL		29.3	61.3	59.1	70.1	2.5	6.5	6.2	10.9	4.0	3.6	8.
Northwest												
	WA	5.1	6.3	6.3	4.4	0.6	0.9	0.9	0.6	0.3	0.3	-
TOTAL		5.1	6.3	6.3	4.4	0.6	0.9	0.9	0.6	0.3	0.3	-
Alaska												
	AK	0.8	12.3	12.3	12.3	-	1.0	1.0	1.0	1.0	1.0	1.
TOTAL		0.8	12.3	12.3	12.3	-	1.0	1.0	1.0	1.0	1.0	1.
TOTAL WEST		109.3	301.9	304.8	375.1	15.1	45.1	45.2	62.2	30.0	30.1	47.
TOTAL U.S.		829.7	1,300.1	1,302.5	1,299.0	231.0	354.8	349.7	351.2	124.0	118.7	120.

Note: Totals may not add due to independent rounding.

ICF INCORPORATED

ATTACHMENT A-2

ESTIMATED COAL TRANSPORTATION TON-MILES AND EMPLOYMENT IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

	Ton-Miles ($\times 10^9$)				Average Number of Workers a/ (10^3 workers)				Employment Change from 1980 to 1995 a/ (10^3 workers)		
		1995 Forecast				1995 Forecast					
Mode	1980	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	1980 b/	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	Base Case	Waxman-Sikorski	Cost-Effective Equivalent
Rail	N/A	462.2	461.4	557.6	6.1	11.6	11.6	13.4	5.5	5.5	7.3
Barge/Lake c/	N/A	68.4	70.0	69.0	1.3	2.0	2.0	1.9	0.7	0.7	0.6
Truck	N/A	9.5	9.5	10.5	5.1	7.4	7.4	9.9	2.3	2.3	4.8
Other d/	N/A	644.8	646.1	647.4	2.0	4.2	4.2	4.2	2.2	2.2	2.2
Total e/		1,105.0	1,107.0	1,284.5	14.5	25.2	25.3	29.4	10.7	10.8	14.9

---

a/ Because the methodology focuses upon those workers directly involved in the movement of coal, total transportation employment requirements are likely to be underestimated.

b/ ICF estimates for 1980 employment were developed by applying forecasted transportation productivity (by origin-destination and mode of transport) to actual 1980 coal flows.

c/ Over many origin-destination routes, rail-barge and all-rail movements exist. In CEUM, these are generally represented as all-rail. As a result, forecasted barge movements are likely to be understated, and rail movements overstated by a similar amount.

d/ Mostly ocean transportation for exports.

e/ Totals may not add due to independent rounding.

ATTACHMENT A-3

PRODUCTION AND EMPLOYMENT SHIFTS IN INDIANA IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

Sulfur Level	Production (10^3 tons) Surface	Production (10^3 tons) Deep	Production (10^3 tons) Total	Average Number of Workers Surface	Average Number of Workers Deep	Average Number of Workers Total	Productivity (tons/man-year) Surface	Productivity (tons/man-year) Deep	Productivity (tons/man-year) Total
1980[a]									
Medium Sulfur	2,113	48	2,161	361	9	370	5,847	5,060	5,827
High-Medium Sulfur	2,415	55	2,470	413	11	424	5,847	5,060	5,827
High Sulfur	10,565	241	10,806	1,807	48	1,855	5,847	5,060	5,827
Very-High Sulfur	15,093	344	15,437	2,581	68	2,649	5,847	5,060	5,827
Total	30,185	688	30,873	5,162	136	5,298	5,847	5,060	5,827
Base Case -- 1995									
Medium Sulfur	2,097	3,443	5,540	626	1,431	2,056	3,350	2,407	2,694
High-Medium Sulfur	2,427	3,440	5,867	751	1,429	2,179	3,232	2,408	2,691
High Sulfur	14,972	3,760	18,732	4,364	1,331	5,695	3,431	2,824	3,289
Very-High Sulfur	11,638	5,025	16,663	2,519	1,516	4,035	4,620	3,315	4,130
Total	31,133	15,669	46,802	8,260	5,706	13,966	3,769	2,746	3,351
Waxman-Sikorski Case									
Medium Sulfur	1,444	3,079	4,524	367	1,262	1,630	3,931	2,439	2,776
High-Medium Sulfur	1,918	3,396	5,314	547	1,408	1,955	3,507	2,411	2,718
High Sulfur	5,818	71	5,890	1,295	12	1,307	4,494	5,827	4,506
Very-High Sulfur	19,392	5,025	24,417	4,676	1,516	6,191	4,148	3,315	3,944
Total	28,573	11,571	40,144	6,885	4,199	11,083	4,150	2,756	3,622
Cost-Effective Equivalent Case									
Medium Sulfur	2,589	3,443	6,033	823	1,430	2,254	3,145	2,407	2,677
High-Medium Sulfur	2,427	3,440	5,867	751	1,429	2,180	3,232	2,408	2,692
High Sulfur	3,478	71	3,549	597	12	609	5,827	5,827	5,827
Very-High Sulfur	8,374	101	8,475	1,634	17	1,651	5,126	5,827	5,134
Total	16,868	7,056	23,924	3,805	2,889	6,693	4,434	2,442	3,574

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[a] 1980 values are estimates, reflecting incomplete data on production by sulfur level. Data were unavailable to vary average productivity in 1980 across sulfur levels.

would likely be gains in industries supplying mines and workers in those regions which increased production. Similarly, changes in employment in related manufacturing industries (particularly those for scrubbers and mining equipment) were not assessed. Further, this analysis does not include any changes in employment and/or standards of living associated with the changes in total national costs of meeting coal and electricity demands.

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